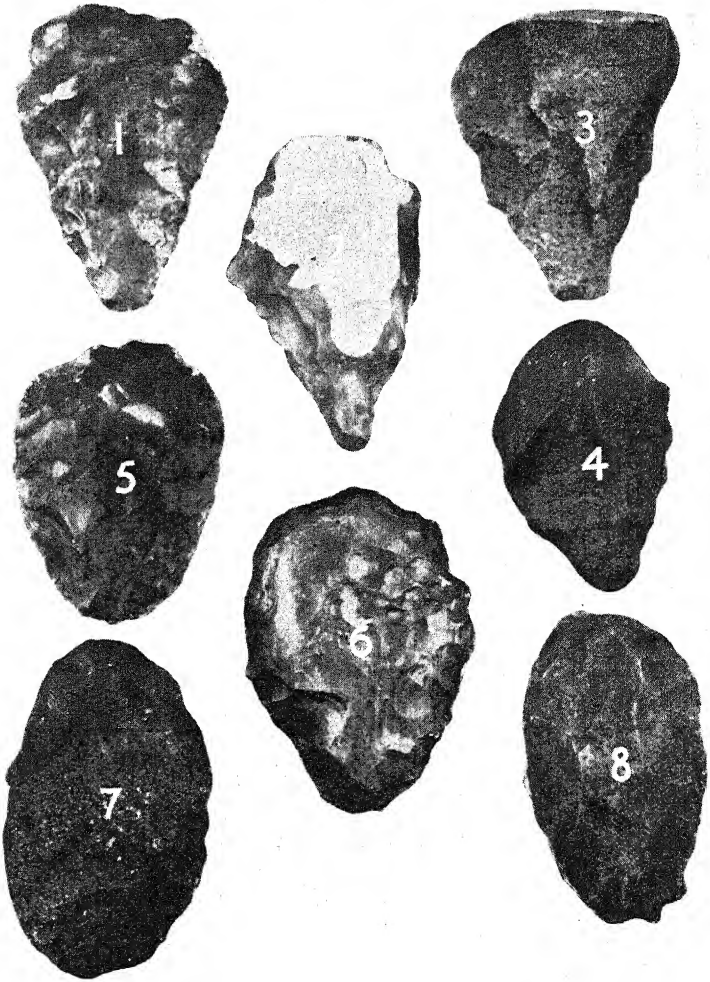

I.—Stone Implements of Lower Palæolithic Types.

(See p. 13.)

Hand-Axes.

1. Surrey, England.
2. Negadeh, Egypt.
3. Stellenbosch, South Africa.
4. Poondi, India.

Sharp-Rimmed "Ovates."

5. Warren Hill, Suffolk, England.
6. Thebes, Egypt.
7. Somaliland, East Africa.
8. India.

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FROM STONE TO STEEL

A Handbook to the Cases Illustrating the Ages of Stone, Bronze, and Iron

(Third Edition.)

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PREFACE

Since the issue of the second edition of this Handbook, in 1923, there have been great advances in our knowledge of the subjects with which it deals, and the preparation of the present edition has involved extensive revision. The relevant museum collections have also had many additions, but the Stone Age series maintain their predominance.

In accordance with the established practice in the Horniman Museum publications, the endeavour has been made in this Handbook to give a readable and reliable account of the subjects illustrated in the cases, rather than a detailed description of the exhibits. This plan has advantages which outweigh its defects, and it has been found that handbooks of this kind reach a wide circle of students and readers, many (and perhaps most) of whom visit the Museum sooner or later.

Archæologists who may chance to come upon this introduction to a vast field of study, will no doubt find statements and views with which they are not in agreement; but in giving an epitome of a rapidly expanding subject it is scarcely possible to avoid error, and when space does not permit of the detailed discussion of debatable points it is sometimes better to put forward a provisional view than no view at all, especially in a subject which so frequently offers an embarrassment of choice. The form of the book has rendered some repetition unavoidable, but it is hoped that this is not obtrusive.

The disproportion between the space allotted to the Stone Age, and that given to later prehistoric periods, arises in part from the relative numbers of specimens of the respective periods in the Museum; there are other reasons to justify the course taken, such, for example, as the fact that collectors and students of stone implements far outnumber those who devote themselves to the metal periods.

The emphasis on Western Europe, and on Britain, to the neglect of other important areas, such as the Danube Valley, is due to the need to keep the book within modest bounds, as well as to the nature and sources of the exhibited material. With the immense increase in our knowledge of the prehistoric archæology of Europe, Africa, and Asia, and especially of the early stages of the civilizations of Egypt, Mesopotamia and Western Asia generally, Crete and the Greek lands, India and China, it has become impossible to give a satisfactory outline of the whole story of prehistoric man, in small compass, and a selective treatment is imperative.

H. S. Harrison,
Curator

HANDBOOK TO THE CASES ILLUSTRATING MAN'S PROGRESS FROM STONE TO STEEL

INTRODUCTION

The present supremacy of man over his fellow-animals, and his power of coercing the forces and products of nature, are the outcome of concurrence of dexterity of hand with versatility of brain. Man's fingers are not fettered by webs, or claws, or hoofs, and his mind is not encumbered by compelling instincts. In the early days of his emergence from an arboreal stock, even perhaps before he came down from his ancestral tree, he no doubt learned that sticks and stones made useful tools, and perhaps also compensated for his lack of natural arms and armour. The careful selection of such tools and weapons, and the shaping of them to more convenient and effective forms, opened up the path of material progress, leading to an unknown goal. The path has become a highway system of discovery and invention, and the human opportunist has now a choice of many routes.

That discovery came first we may be sure, since it arose from observation of the nature and behaviour of the common objects of the early human habitat, a kind of knowledge that was essential to man's ancestors even before they were men. Only when there were artificial products of discovery, in the first place one-piece implements, could invention begin to play a part in the creation of composite appliances and simple mechanisms. By slow degrees, but at an immensely quickened rate in recent times, man has exploited his environment, until in civilized communities it is the artificial, rather than the natural, that looms largest in men's lives.

That the earlier types of man were lower in their innate mentality than we are ourselves may perhaps be assumed, but with the first appearance of men who were physically of modern type, and of our own species (*Homo sapiens*), it may be that human mental capacity had reached its upper limit; and that since Aurignacian times—say 15,000 years or so ago—all human progress has been due to the accumulation of knowledge and experience which has resulted in the construction not only of material artefacts, but of the codes and customs which form the framework of human societies of whatever grade. We cannot assume that there has been any directional improvement in man's inborn power to deal with the problems of his expanding environment. His future, like his past, apparently depends on his constructive reaction to the stresses and strains of his social inheritance, which calls for constant regulation and adjustment.

However this may be, the production of new or improved implements of the chase, of agriculture, and of many other kinds, has played an essential part in man's advance from savagery to civilization, and the discoverer or inventor has always been dependent upon the work of his predecessors. Man's power of speech, his aptitude for the co-operation of the social life, and other human powers and tendencies, have been equally essential, but they cannot be discussed here.

Historical records, on paper, papyrus, stone, or clay, carry us back some four to five thousand years into the past history of some of the civilized peoples of bygone days, but our knowledge of man's mode of life in the long periods of prehistoric time is mainly derived from discoveries of the implements he made and used. These are only available when the materials of which they were made are relatively indestructible, as in the case of stone and baked clay (pots and potsherds), and when conditions have ensured their preservation in situations where accident or search has led to their discovery.

It is now well known that for many thousands of years before any history was recorded man relied very largely upon stone for his tools and weapons. Implements of flint and other kinds of stone are the oldest known relics of his presence in any part of the world, and in many cases they are proved to date from very remote times.

In Europe and elsewhere, prehistoric man passed through a prolonged stage of material culture of which stone implements were so characteristic that the period of its duration is called the Stone Age. It is not to be understood that no other material was used, since remains of implements of wood and bone have also been found, and it is probable that these played a much more important part in early human cultures than is suggested by the material evidence. At the present time (or in some regions till within the last hundred years or so) stone is used for tools and weapons by some backward peoples, and such substances as wood and bone are extensively employed. The Stone Age may therefore be said to have lasted till the present day, but even in remote and secluded parts of the earth, it is now rapidly passing away.

From Stone to Steel in Europe.

The Age of Stone.—The Stone Age in Europe is divided into two main periods. The earlier of the two, called the *Palæolithic* (or *Old Stone*) *Age*, is represented by stone implements of characteristic forms, often of fine workmanship, but never ground and polished; they were often shaped by the removal of "flakes" by means of blows or pressure, from a pebble or block of stone, and flakes were themselves often chipped to form implements. Such implements, together with others of bone and

antler, and also small carvings and larger cave-paintings, are almost the only remaining evidences of the material culture of Palæolithic man. He lived no doubt by hunting and fishing, and by the collecting of shell-fish, roots, seeds, fruits, and other miscellaneous foods, as do some backward peoples of to-day (" food-gatherers " as opposed to food-producers).

Some investigators believe that certain flints, to which the term " eoliths " is often applied, show evidence of the work of man in times previous to the Palæolithic Age ; they are of various types, dating from various early periods, and some of them would, if accepted as implements, extend the age of man far back into the Tertiary (geological) period. The question as to the nature of such stones has been under discussion for many years, and they are not universally recognised as being of human workmanship. Some of them, such as the Sub-Crag flints of East Anglia, have, however, acquired a respectable status in the eyes of many archæologists. (See p. 33).

Bridging the gap that was formerly supposed to exist between Palæolithic and Neolithic times is a transitional period now often called the *Mesolithic* (or *Middle Stone*) *Age*, in which several distinct cultures are included (see p. 55). Man in Western Europe was still a food-gatherer, whilst in the Near East much higher cultural levels, based on the growing of corn, had been reached.

The *Neolithic* (or *New Stone*) Age is characterised not only by a greater variety of stone implements, some forms of which were usually finished by grinding and polishing, but there are also many evidences of man's activities in other directions. He was no longer dependent upon hunting and collecting for most of his food. Much knowledge has been gained of his dwellings and his tombs, of his domesticated animals, his cultivated food-plants, his personal ornaments, and of his general manner of life. In Western Europe the Neolithic culture was of late arrival and brief duration, beginning perhaps not earlier than about 2,500 B.C. and ending soon after 2,000 B.C.; but in the Near East copper was known in the fifth millennium B.C. (though it had not yet begun to displace stone), and Neolithic arts and crafts were already practised. With the progress of research the Neolithic Age is losing the sharp definition formerly given to it, and in some regions it is by no means easy to separate it from an equally indefinite Age of Copper. Recognition of the overlap is sometimes made by the use of the term *Chalcolithic* (or alternatively, *Aeneolithic*) *Age*.

The Age of Bronze.—A considerable degree of primitive culture is attainable even by peoples entirely ignorant of metal. Copper, bronze, and especially iron, are, however, so adaptable to purposes for which stone is ineffective or useless, that the discoveries of the metals gave rise to great advances in material

culture. Copper was the first to be widely used for implements, but the manner and place of the discovery of its properties cannot at present be decided. Gold was perhaps known before copper, and used for ornaments—as was copper itself in the beginning—but it was too soft for implements. Both of these metals no doubt owe their precedence in part to the circumstance that they occur naturally in the metallic state ("native"), in part to the fact that when a clean surface is exposed the metal attracts the eye; and finally to what was, no doubt, to early man, their unexpected reaction to blows—they are both malleable, and it was by hammering the metal into shape that the first copper implements were made. That the metal could be melted in a fire was a later discovery, followed by the further discovery that it could be cast in simple shapes. That copper could be obtained from certain kinds of "stone," i.e., from copper ores, was a still greater discovery, from which methods of smelting were developed.

The greater hardness of bronze, which is an intimate mixture (alloy) of copper and tin, renders it much more serviceable than copper alone. Ores of copper are very occasionally found associated with ores of tin, and the smelting of such a mixture of ores may possibly have led in the direction of the production of bronze.

The Age of Bronze was not of great length (from about 2,000 B.C. to 800 B.C. in Western Europe), but in some regions (e.g., Hungary, Scandinavia) the technique of bronze-working reached a high level.

The Age of Iron.—Before the beginning of the historical period in the West, bronze was succeeded by iron, and at the present day we may be said to be still in the Age of Iron, if we do not prefer to call it an Age of Steel. In view of the evidences of the value of iron and steel which are all around us, there is no need to lay stress upon the superiority of this metal over its predecessors. The utilization of iron for tools and weapons began in Western Asia at least as early as the 14th century B.C., but it was not until late in the 7th century B.C. that Britain entered on its Early Iron Age.

We have thus in the history of man in Europe a succession of periods characterized by the kinds of materials used for the effective parts of tools and weapons. Stone, copper, bronze, iron, steel, represent successive steps in man's appreciation of the materials at his disposal, and in his ability to make use of them.

The word "Age," as used in connection with these advances in knowledge, must not be understood to have a precise significance, even in Europe. Some peoples lagged behind in the progress and spread of knowledge, and in all parts there was overlapping of the periods, the less serviceable material remaining in use to a greater or less extent after the advent of its successor.

North-west and Western Europe were considerably later in passing from stone to bronze, and from bronze to iron, than were the peoples of the Eastern Mediterranean, and of some parts of Central and South-Eastern Europe. This was due to the fact that these precocious regions were more easily accessible to influences from the early metal-working areas. Again, it should be clearly understood that though such terms as "Age of Stone," "Age of Bronze," are convenient for characterising certain periods, they fail to indicate the numerous other lines of advance along which man has made his way.

Special importance must be attached to the great changes brought about in man's mode of life when he learned to domesticate animals and cultivate food-plants, more particularly cereals such as barley and wheat. In Europe these great advances towards civilisation first become manifest with the supplanting of the Palæolithic and Mesolithic food-gatherers by the Neolithic herdsmen and cultivators; but our knowledge of the manner of this displacement is still fragmentary. On the other hand, the transition from stone to metal presents itself to us as a less revolutionary process, which was not accompanied by any fundamental advances in other directions, though the eventual outcome was of supreme significance for the development of human culture. Even in early days the fact that the bronze-founder needed special skill and knowledge, must have tended towards a division of labour more marked than any existing in the Stone Age.

Stone and Metals outside Europe.

In considering the succession of culture stages in extra-European countries, it is necessary to treat each area upon its own merits. The aborigines of Australia, the greater part of America, and some other regions, may be said never to have got beyond the Age of Stone, except in so far as some of them have adopted the implements and methods of civilised man within the last few hundred years. Over a considerable part of Africa, on the other hand, the working of iron has long been understood, and it appears that this metal immediately succeeded stone. Egypt, and Mesopotamia, India, China, and other parts of Asia, passed from stone to copper and bronze and then to iron in early times. Whether such progressive steps were due to independent discovery in the several regions concerned, or were the results of diffusion of knowledge from single centres by migrations and contacts, is a question which has been vigorously discussed, but the predominance of diffusion as a cause of progress and change is becoming more and more widely acknowledged. Most of the elements of Neolithic and later prehistoric cultures, for example, came to Europe from the Near East, the British Isles lying at or near the end of the journey.

The stone implements of the Old World fall into two main groups, one resembling those of the European Palæolithic Age, and the other, those of the Neolithic Age. The two kinds are not found in all parts of the world, implements of Palæolithic types being less widely distributed than those of Neolithic types. The former are in most cases, though not yet in all, proved to be of great antiquity. Within recent years, in Africa and parts of Asia, discoveries have been made which greatly extend our knowledge of the variety of cultures than can be assigned to Palæolithic times, and in large measure correlated with those of Europe. The Mesolithic cultures have also been shown to have had a wide distribution.

In the regions which have not yet, or have only recently, emerged from the Stone Age, the implements are usually of Neolithic type, and some forms are usually ground and polished. Tasmania is an exception to this rule.

It must be constantly borne in mind that in speaking of an implement of extra-European origin as being of Palæolithic or Neolithic *type*, there is no suggestion made as to its age; indeed, there are implements of both types, the age of which is quite uncertain. In general, however, it may be said that implements of well-defined Palæolithic types are at the least under suspicion of being of Palæolithic Age, unless they can be proved to be of more recent date.

The Arrangement of the Cases.

The series to which this Handbook refers occupy the horizontal cases on the South Balcony, and the arrangement is from left to right. The first few cases, containing the Index Series, illustrate various points in the forms, distribution, uses, and manufacture of stone implements. In this Index Series, chronological sequence is disregarded, the specimens being of various ages and from many regions; special attention is, however, paid to flint-working, which was so important in the European Stone Age.

Following on the Index Series is a Chronological Series illustrating the Stone, Bronze, and Iron Ages in Europe, the Stone Age being treated much more fully than the others. (Cases 5-37).

Specimens from Egypt and the rest of Africa, from Palestine, India, Japan, and other parts of Asia, chiefly stone implements, are in the following cases, each country being considered independently of the others. Upon these follow stone implements from America and Oceania, where the Age of Stone has not quite come to its end; only a selection of specimens is shown here, most of the hafted implements being exhibited in the sections devoted to the tools and weapons of modern races.

A small series is arranged to illustrate the utilisation of products of civilization, such as iron and glass, by peoples who were in their Stone Age at the time of their discovery by Europeans. Specimens illustrating the modern manufacture of gun-flints, etc., at Brandon (Suffolk), in France, in Albania, and in Central Africa, and a small collection of counterfeits and forgeries of flint implements, occupy the last four cases.

Explanation of Plates.

A comparison of the figures will show the general distinctions between the larger implements of Palæolithic and Neolithic types respectively. The wide distribution in the Old World of the Palæolithic types figured, and the still wider distribution of the Neolithic types in both the Old and New Worlds, should be noted. The specimens figured on both plates are specially selected to show the great similarity in form between implements from widely separated parts of the world; this is particularly conspicuous in Nos. 5 and 6 on Plate I, and Nos 1-4 and in 5 and 6 on Plate II. It is now generally believed that the Palæolithic resemblances were due to the diffusion of these implement types, and not to their independent origin in various parts of the world.

On Plate I, the specimens from England belong to th Lower Palæolithic, or "River-drift" Period of the Palæolithic Age. Those from Egypt and India are of considerable antiquity, and date back to a period corresponding to the European Palæolithic Age. Those from South Africa and Somaliland are probably equally old. Nos. 1, 2, 5 and 6 are of flint, and Nos. 3, 4, 7 and 8 of quartzite.

On Plate II, the specimens from Ireland and Denmark belong to the European Neolithic Age. That from India no doubt dates from an equally distant period. Those from the West Indies and South America were made by the ancestors of the existing American Indians, and may be only a few hundred years old, or less. Those from Australia and New Guinea may be of quite recent date; in parts of New Guinea such implements are still in use as heads of axes or adzes, as may be seen from many exhibited specimens (see Tools, Balcony Wall-Cases, 71-79).

INDEX SERIES

THE FORMS AND THE DISTRIBUTION OF STONE IMPLEMENTS.

Cases under arches, A—D)

We are dependent upon conjecture for our ideas as to the manner in which primitive man began to realise the uses to which stones might be put. It may be that they were first used as missiles, since some apes are known to throw nuts and fruits at intruders. However that may be, the value of stones for throwing at an enemy, for cracking nuts, and when sharp-edged, for chopping or sawing off boughs, scraping the meat off bones and for other simple purposes, may have been realised at an early stage. Man's opportunism kept pace with his increasing aims, and he ultimately passed from the utilisation of stones naturally or accidentally suited to his purpose to the production of tools and weapons of definite forms. He thus became a tool-making animal and his destiny was indicated.

Progress is made in human inventions by small and unimportant variations as well as by mutations, or jumps, of greater significance. Only the simplest implements could arise out of the early simple discoveries, and for the evolution of a composite tool, such as an axe or an adze, several discoveries and inventions were necessary. The Neolithic stone-headed axe, in fact, like the modern aeroplane, resulted from the gradual improvement of less efficient predecessors. A rounded stone used as a hammer, and a sharp-edged stone for chopping, cutting, sawing, and scraping, were the remote "ancestors" of our metal hammers, axes, adzes, chisels, knives, saws, planes, and other tools. The simple stone implement, used for many different purposes, has thus given origin to tools and weapons whose uses are more restricted, but which are better adapted to the special purposes for which they are made. Stone implements of considerable variety of form, and with various uses, have been made by prehistoric and existing peoples, and the first cases of the Index Series illustrate the forms and distribution of the principal types.

The names given to some of the prehistoric implements, and the uses attributed to them, must be taken with reserve, since there is often no direct, and little indirect, evidence to show the method of use. This is especially the case with the Palæolithic types, which are the less specialised, and had no doubt to serve many purposes. The shapes of many of the Neolithic implements give reliable clues as to their uses, though the fact that in recent times such forms as "arrow-heads" and "axe-heads" have sometimes been put to other uses (e.g., as drill-points and scraper-blades respectively) indicates the need for caution.

Only the well-established and more typical implements are illustrated in the Index Series. For less standardised forms, and

for variations in type, reference should be made to the exhibits under localities in the Chronological Series.

The Hammer-stone and the Club-head.

Although rough stones and rounded pebbles were probably used by primitive man for many purposes, it is only when the stone was battered and chipped by blows on hard material that we are likely to suspect it of having been an implement. Such evidence of hard usage would be brought about when a pebble was used in the manufacture of other stone implements, or in pounding food on stone.

Hammer-stones, as they are called, have been widely employed for making stone implements, probably from very early times. In their simplest forms they are naturally-rounded pebbles, often of quartzite, of convenient size for holding in the hand, but they have also been made from pieces of flint or other stone trimmed to a suitable size and shape. In some cases it is possible that the hammer-stone was made more convenient for use by grinding out a pit on each side for the reception of thumb and finger, though other explanations of this feature have been offered.

The simple hammer-stone continued in use for the making of stone implements long after methods of attaching a stone head to a haft had been devised. There is no direct evidence to indicate how the hammer-stone became a hammer-head, though modern stone-headed implements from America and Australia show very simple methods of hafting. A groove round the stone for its more secure attachment is a frequent feature in the implements of the North American Indians, and it is found less commonly elsewhere.

The perforation of the stone for the insertion of the haft is found both in European Neolithic and Bronze Age specimens, and in modern examples from Oceania. In the latter region the stone is used as a club-head, and the same was no doubt the case with many of the perforated stones of Neolithic and Bronze Age Europe. The use in recent times, in Africa and America, of perforated stones for weighting digging-sticks, must, however, be borne in mind.

Some perforated implements are blunt at one end and more or less sharp-edged at the other, and are therefore often called axe-hammers, or in some cases, " battle-axes." The use of these, and indeed of most perforated axe-heads and club-heads, continued in Europe after metal was in general use.

Palæolithic Hand-axes and Ovate Blades.

The form and size of Palæolithic implements are the only features giving us any clue to the purposes for which they were used. For breaking open hard fruits, grubbing in the earth for

roots, splitting open the skulls or bones of animals to extract the contents, and for hand-weapons, any suitable heavy or jagged piece of stone or rock was no doubt chosen by early man. Palæolithic man made implements having a thick wedge-shaped edge, opposite to the heavy rounded butt, and these must have been held in the hand and used for hacking and chopping. Similar implements were made in Neolithic times, but no very definite standard of form appears to have been arrived at in either period.

The best-known type of Palæolithic implement is one which is called the *coup-de-poing*, or hand-axe. In form it is often not unlike a flattened pear, and it is also sometimes described as tongue-shaped and almond-shaped. The earlier forms (Chellian) have a thick butt for grasping in the hand, and taper to a pointed or curved end, the sides being irregularly edged. In later forms (Acheulian) the edge may extend all round the implement, which is thinner and more symmetrically shaped. These implements had a considerable range of form and size; they no doubt served as knives and choppers, as well as for a variety of other purposes, either without hafts or perhaps with them.

A variant of the hand-axe is a form called a cleaver, which has a broad cutting edge at the effective end; this implement was often made from a large flake, and it occurs in Africa and India, as well as, less frequently, in Europe.

Derived, no doubt, from the hand-axe is the more or less disc-shaped "ovate blade" of Acheulian times, which has an oval or ovate outline and a cutting edge all round. The implement is thinner than the ordinary hand-axe, and could be more easily hafted, either as a knife or axe.

These two forms are not confined to Europe (see Plate I); they are found also in several parts of Asia and Africa, often under conditions indicating that they must be regarded as Palæolithic in age as well as in type. No undoubtedly modern examples are known, and they were not made by Neolithic man. There are no types which give evidence as to the evolution of the axe-head of Neolithic times, and indeed it is improbable that this was developed from such specialised forms as the hand-axe and the ovate.

The Axe, Adze, Chisel, and Gouge.

Stone axe-heads are perhaps the best-known implements of the European Neolithic Age, and they are also the most widely distributed products of the Stone Age in other parts of the world. In Europe they were made in great numbers, of flint and other kinds of stone, and were frequently ground and polished to a smooth surface. Their shape varies considerably, but they all agree in having a cutting edge, the butt-end being usually blunt.

Some of them are shaped by flaking alone, and of these, some are no doubt unfinished specimens, others were made in haste or for rough purposes, whilst yet others may have been made by unpractised hands. (For Hafting, see p. 19).

Modern stone axe-heads and adze-heads of Neolithic type have been found in many parts of the world, and specimens from Oceania, America, and other regions, are often practically identical in form with European examples (see Plate II). The axe or adze is the most important tool of wood-working peoples, since it is essential for the procuring and shaping of material for huts, canoes, and other wooden structures. It may be noted that such stone implements are sometimes used in the preparation of trees or logs which have been charred by fire, and thus rendered less resistant to the blows of primitive tools.

Implements of this form have been used in primitive agricultural work, and some of them may therefore be regarded as hoe-blades. The "shoe-last" celts of Eastern Europe were perhaps of this nature.

It is often impossible to decide whether a given haftless stone implement was used as an axe-head, an adze-head, or a chisel. The adze-head, which is adapted for attachment to a haft in the same way as the axe-head (but with the edge of the blade transverse to the plane of the stroke of the tool), may often be distinguished from the latter by the fact that one of the faces is bevelled off at the edge.

The chisel is usually narrower than either axe-head or adze-head, and the gouge has one face, or a part near its edge, hollowed out.

The word "celt" is often applied to implements of the above-mentioned types, and the term is also used to include bronze implements of the same class.

Examples of the *shell-mound axe* and the *pick* will be found in the case containing implements of the Mesolithic Age (see also p. 55).

The Scraper.

Such implements as stone axe-heads, chisels, and gouges are comparable in their shapes with their modern representatives in iron or steel, but the scraper may be regarded as a form which was never made in metal. It was used in both Palæolithic and Neolithic times, and many eoliths are of similar forms; in America and other parts of the world scrapers of stone have been used down to modern times. Tools of this type are so abundant amongst the implements of the European Stone Age, that they must have had important uses. Perhaps the chief of these was in scraping the flesh and fat off skins to reduce them to a condition suitable for making into clothing. Other uses may have been in the scraping of flesh off bones, and in smoothing implements of wood and bone.

Some scraper-like implements may have been used for producing fire, by rasping or striking a piece of iron pyrites.

The typical scraper is made from a flake, one of the edges being made steeper and stronger by the removal of small chips. It is often difficult to say whether a given implement was made for a scraper or for a knife, and indeed the two functions grade into each other. In many cases there is a cutting as well as a scraping edge on the same implement.

Both Palæolithic and Neolithic scrapers occur in a variety of sizes and forms, some being rounded in outline, others more elongated. The usual type has the scraping edge convex. The side-scraper or *racloir* has the scraping edge along the side of the flake, whilst the end-scraper or *grattoir* has the scraping edge at the end opposite to the bulb of percussion (see p. 24). It is probable that many scrapers were used in the hand, without a haft or holder of any kind, though the modern Eskimo, for example, have scrapers of stone (used in skin-dressing), which are fixed in small ivory handles.

In addition to the more common type of scraper, with a convex scraping edge, another well-known form is the concave (sometimes mis-called "hollow") scraper, which has had a wide distribution in both Palæolithic and Neolithic times. Notches occur on other Palæolithic implements, and it is probable that such notches were made to fulfil the same functions as the concave scrapers. These may have been to finish off the wooden shafts of spears or clubs, and to scrape and smooth bone implements.

The Knife and the Saw.

The primitive knife was probably a sharp-edged piece of stone used indifferently for cutting, scraping, or hacking, and the earliest rough tools of this character may be regarded as the forerunners of knives proper. A simple and effective knife, however, may be made by striking off a flake from a piece of flint or other suitable stone, and in both Palæolithic and Neolithic times cutting implements were produced in this way. Such flakes, or blades (as elongated narrow flakes may be called), have an exceedingly keen, though brittle, edge, which cannot be made sharper by chipping. In Neolithic times, however, knives were made of symmetrical forms, the whole of both surfaces being carefully worked so as to produce a finished tool with a stronger edge.

It is often difficult to say whether an implement is intended for a knife or a spear-head, and it is probable that some Palæolithic and Neolithic leaf-shaped "points" were made for use as knives. As already said, the line between knives and scrapers cannot be clearly drawn, and in fact there is no doubt that primitive man

used one form of implement for many purposes, as we do our pocket-knives.

The stone knife probably gave origin to the dagger and to the spear-head.

In many cases the stone knife was inserted into a handle of wood or bone. The Neolithic men of the Swiss Lake Dwellings fixed their flint blades in handles of wood, and the modern North American Indians and the Eskimo also had stone knives with ivory or wooden hafts. Some tribes of Australian aborigines embed the butt-end of a simple flake of quartzite in a mass of tree-gum, or porcupine-grass resin, which hardens to form the handle; or the handle may be made of a flat piece of wood together with the resin.

The stone knife is not so widely distributed as the celt. In the warmer parts of the world, as in the Pacific, pieces of bamboo, split so as to leave a sharp edge, have been much utilised for cutting purposes, and so also have shells and teeth. (See Tools, in Wall Case 71.)

The early cutting implements were no doubt often used with a sawing motion, but in the Neolithic Age flint blades were definitely chipped to a saw-like edge. Such flint "saws" are found in Denmark and other parts of Europe, and also in Egypt and Palestine; many saw-edged flints, are, however, parts of sickles, a series of them being fixed in a bone or wooden holder, straight or curved. Some of these "sickle-flints" show a high polish at the cutting edge, which is due to the friction of the silica in the stems of cereals (often, at any rate, wheat or barley), during the process of reaping.

Perforators or Borers.

For boring holes in wood, bone, and skin, for perforating shells for use as beads, and for other like purposes, small pieces or flakes of stone, worked to a point, have been widely used. Various names have been given to these implements, such as drills, awls, borers, and perforators. Probably some of them were used in the hand, but others may have formed the points of sticks used as drills, as in the pump-drill of New Guinea and elsewhere. In addition to European Palæolithic and Neolithic specimens, they have been found in Egypt, Japan, America, and other parts. Neolithic and later specimens are often of delicate workmanship.

Bone awls have had a very long history, from Palæolithic to modern times, and they survive in various forms in civilised countries.

The Burin or Graving-tool.

Gravers, or burins, are small flake-implements which are typical of, though not confined to, the Upper Palæolithic period.

They correspond to small chisels and gouges, the working-edge being very narrow ; it is formed by the removal of one or more very small flakes by means of a blow, or blows, taking effect down the long axis of the graver-flake. In many cases, however, the technique is more elaborate. Gravers have been classified into a number of groups, some of which no doubt represent intentional differences in type.

As is suggested by the name, an important use of gravers was probably in connection with the carvings and engravings of the later cave-men, especially those on bone, antler, and ivory. Other uses have been suggested, however, and indeed gravers have been found in numbers in areas where no such carvings or engravings occur.

The Spear-head.

The spear has at some time or other been used in practically all parts of the world inhabited by man. In its simplest form it is a long slender staff, sharpened at one end, and sometimes with the point hardened by fire. Amongst modern races having no knowledge of the metals, various methods have been adopted for making the weapon more effective, as by the attachment of wooden or bone barbs to the point.

In parts of Australia a flake (or worked blade) of quartzite or other stone forms the point, and in the Admiralty Islands a flake of obsidian is similarly used. In Europe the earliest stone implements that suggest spear-heads were made in Middle Palæolithic times, though it is by no means proved that the cave-men used stone-headed spears, and in any case bone (from antlers) was a more usual material for the heads of harpoons and spears.

Stone implements suitable for use as spear-heads were made in the Neolithic Age in Europe, and similar types occur in North America, Australia, and other parts. Although many specimens are finely worked, some are simple pointed flakes, with a little working at the butt-end to form a tang. No hard-and-fast line can be drawn between spear-heads and arrow-heads ; the latter may be small enough to seem unmistakable, but in North-West Australia, for example, the stone spear-heads are often as small and delicate as arrow-heads.

The Arrow-head.

The arrow is a later invention than the spear, from which it was probably derived. We have, however, no clue as to when and how the bow was invented as a means of discharging small spears with greater effect than by the hand or the spear-thrower. It appears to have been used in Spain as early as the Mesolithic Age, and it no doubt had a still earlier origin, perhaps in Egypt or Western Asia.

Stone, usually flint, arrow-heads of the Neolithic and Bronze Ages, have been found all over Europe, and they remained in use down to historic times in parts of the area. In America they were in use at the time of the discovery, and for many years after, and are said to be even now employed by some of the wilder tribes of Central America. Stone arrow-heads have been found in Africa and in parts of Asia; the bow is not known to the aborigines of Australia, and no ancient or modern arrow-heads are found there. Again, the points of arrows are not made of stone in the Pacific Islands (except in a restricted area of New Guinea), and there are no indications that this was ever the case.

Stone arrow-heads of symmetrical form occur in a number of varieties. The leaf-shaped; the lozenge-shaped; the elongated, with tang; the triangular, with or without barbs produced by a notch in the base; the triangular with barbs and tang; these are all forms having a wide distribution. Certain shapes, such as that with a notch on each side of the base, which is characteristic of North America (though found also in Japan), have a more limited range. The Egyptian form with very long barbs and no tang, is also characteristic, though it is not confined to Egypt. The edges of the arrow-heads are sometimes serrated, and this is especially conspicuous in some specimens from Egypt and North America.

Many variations of the above types occur, and specimens are also found with one barb only, others with the end terminating in a transverse edge instead of a point (as in the *petits tranchets*), and others again with a blunted point. There is evidence to suggest that some of the geometrical microliths of the Mesolithic Age may have been used, singly or in sets of two or three, to form the points of arrows.

Implements of arrow-head form were sometimes mounted as knives and as the points of drills, modern examples occurring amongst the tools of some North American Indians.

THE HAFTING OF STONE IMPLEMENTS.

Table Case)

In the case of prehistoric stone implements it is often impossible to say whether they were simply held in the hand during use, or whether they were attached to some form of haft or handle. Certain types, such as arrow-heads, obviously require mounting, but others, such as large celts and scrapers, might have been used either with or without a handle. Amongst existing primitive races the hafts of stone implements are usually of wood (though sometimes of bone or ivory) and assuming that this was the case in prehistoric times also—as in some known examples—it is not surprising that most of them should have decayed without leaving any traces. No remains whatever have been found of the hafts

of Palæolithic implements; some of the ovate sharp-rimmed implements may quite probably have been hafted, and the same is true, with an approach to certainty, of many of the points and blades of the Cave Period.

We reach even surer ground when we come to consider some of the Neolithic implements. Specimens have been found in this country and on the Continent in which the stone and its haft were preserved in their original relationship. For example, a stone axe-head was found in Solway Moss, with the wooden haft still attached, the latter being merely perforated near one end and the butt of the axe-head fixed in the hole. In the Swiss Lake Dwellings also, stone axe-heads have been found with a similar method of hafting; in some examples, however, the probability of the wood splitting when a blow was struck had been lessened by the use of a socket, or "sleeve," of deer-antler, in which the stone was fixed, the stem of the socket passing into the hole in the haft, and by virtue of its elasticity serving to diminish the shock of a blow. The Swiss Lake Dwellings have provided many examples of Neolithic hafted implements, chiefly in the form of axes, adzes, knives, and saws. Something is known, also, of Mesolithic methods of hafting.

The rarity of hafted stone implements of the European Neolithic Age compels us to turn to modern stone tools and weapons for suggestions as to other possible methods practised in prehistoric times.

The principal methods of providing a stone blade or point with a hand-grip or a haft may be classified as follows:—

1. Hand-grip. This may take the form of a mass of hardened gum, a pad of hide, or a binding of withies, to give a grip and to protect the hand when a stone blade is used as a knife or dagger.

2. Attaching to a wooden haft by means of a cement, such as resin or gum. This method is used in Australia, and less often elsewhere, for constructing axes, picks, and knives. Spear-heads are affixed to their shafts by the same means. As a rule the method is used in combination with other devices, the gum being sometimes only an accessory.

3. Doubling a strip of hide, or a length of flexible wood, round the stone. The American Indians frequently used this method for hammers, clubs, and axes, the stone being often grooved. When hide was used, the stone (forming the head of a club) was sometimes enveloped entirely, the wooden haft being also wrapped with hide. In parts of Australia the flexible wooden haft of an axe is bent round the stone blade, further security being given by a mass of hardened gum, in which the butt of the blade is embedded, and also by lashings which hold together the two limbs of the haft.

4. Inserting the stone into a hole, or slit, or groove in the haft. A distinction must be drawn here between what may be called *longitudinal* or *straight hafting*, and *transverse* or *angled hafting*. The former is exemplified by the fitting of an arrow-head, or a spear-head, into a slit or a socket (often natural), at the end of a shaft of wood, reed, or bamboo. This is a very widespread method, and reinforcement is usually given by means of a lashing, a coating of gum, or both.

Angled hafting in this class is not very common, and is almost confined to axes. A hole, or slot, for the stone blade is made transversely near the end of a wooden or bamboo shaft, as is shown in the Dutch New Guinea specimen exhibited. The method was used in Neolithic times in Europe, but in some instances, especially in the Swiss Lake Dwellings (as already mentioned), the stone blade was held in a " sleeve " of deer-antler, the butt of which fitted the hole in the haft. Comparable with this type is the New Guinea axe shown, in which the sleeve is represented by a clamp made of two pieces of wood bound together, gripping the stone blade between them.

5. Binding the stone to a wooden haft. The use of lashings and bindings is very general, either as a sole means of attachment, or as a component. In the Pacific Islands especially, though by no means exclusively, axes and adzes are made by lashing a stone blade to the short arm of a " shouldered haft " (i.e., of pick-like form). Here again the stone is often gripped in a sleeve consisting of two pieces of wood bound together, and the sleeve is lashed to the haft.

6. Inserting a handle through the perforated stone blade (shaft-hole axe-heads, etc.). This method is almost entirely restricted to axes, hammers, and clubs. The stone-headed clubs of New Guinea are good modern examples of the method, which was used in Neolithic and Bronze Age Europe.

Although the above classification gives a general idea of the chief methods employed, it does not exhaust the list of devices known to stone-age peoples. With the advent of metal other methods were developed, though most of the old ones still persisted. One of the chief advances associated with the evolution of metal implements was in the use made, especially in the Bronze Age, of the longitudinal socket (e.g. of spear-heads and socketed celts); the transverse socket (shaft-hole) also became of more importance, and the axe-head of this type eventually displaced the socketed celt, which scarcely survived into the European Iron Age. The cases of Tools (Balcony Wall-Cases 71-79), and those containing hoes (Cases 30-32, in the South Hall) afford many examples of interesting methods of hafting implements of iron and steel, whilst others may be found in the Weapons section.

THE MAKING OF STONE IMPLEMENTS.

Cases 1–4)

Flint was of such great importance to the men of the European Stone Age, that it demands special consideration in any account of the manufacture of stone implements. Many other kinds of stone were used, especially in the Neolithic Age, but none so extensively as flint. Its special virtues lie in its hardness, its homogeneous texture, and in the readiness with which it flakes so as to give a sharp cutting edge. Owing to the fact that it often breaks in such a way that rounded shell-like surfaces are produced, bearing concentric ridges, flint is said to have a *conchoidal fracture*. Its behaviour under various natural and artificial conditions has important bearings on many problems relating to the origin and age of chipped flints.

Chert is an impure kind of flint, of different geological origin (it is found in limestone, not chalk), but of almost equal value for making into implements.

In this section the working of flint is considered with special reference to the Stone Age in Western Europe, where the art was most characteristically developed. In many parts of the world flint does not occur, though excellent substitutes may be obtainable (e.g. obsidian, or volcanic glass, in East Africa, Mexico, etc.).

The Sources of Flint.

Flint is found abundantly in the deposit known as the Chalk, where it occurs in layers of larger or smaller variously-shaped blocks, which are white on the surface, the interior being grey, brown, or nearly black. It is also found in regions where the chalk deposit was once present, but has been removed by denudation or gradual washing away; in this case the flint is in the form of blocks or pebbles, which are often found together in large numbers on or near the surface of the ground, as well as in river-deposits of gravel.

In all periods of the Stone Age in Europe flint pebbles were used for making into implements, but in the Neolithic Age, and perhaps earlier, man had discovered the original source of the flint. At Cissbury (Sussex) and at Grime's Graves (Norfolk), Stone Age man excavated shafts into the chalk to a depth of from ten to thirty feet, and made galleries from the shafts into the best seams of flint. Mines of a similar kind have been found on the Continent.

It should be noted that flint fresh from the chalk is much more easy to work than are flint pebbles or derived blocks, and also that there are other variations in the quality of flint from different sources.

The Flaking of Flint.

In making an implement from a block of flint, or from a pebble, a hammer-stone was used for striking blows to reduce

the flint to the proper form. In the manufacture of the larger implements, such as Palæolithic hand-axes and Neolithic axe-heads, a suitable block was chosen, and brought into shape by a succession of blows, each blow removing a portion of the flint. The implement was therefore formed from the central part, or *core*, of the flint (*core-implement*), the *flakes* removed being either discarded, or, if suitable in shape, no doubt used for making into smaller implements (*flake-implements*), such as scrapers, knives, and arrow-heads. For the latter purposes, also, pieces of flint were specially worked, the flakes being then regarded as the portions to be preserved, the core being usually discarded. Large flakes were sometimes shaped into hand-axes and celts. Both flakes and cores are often found in numbers on ancient flint-working sites, together with broken, unfinished, and usually some finished implements.

Although the hammer-stone played a very large part in the manufacture of implements, it may be that punches of stone or other hard material were also employed, and stones of various sizes as anvils. Wooden implements appear to have been sometimes used for striking off flakes. In the finishing of the smaller implements, such as arrow-heads, it is not to be doubted that small flakes were removed by pressure, an implement of stone or antler being used for the purpose; such implements are spoken of as *fabricators*, and the process of flaking by pressure has been observed amongst modern Stone Age peoples in several parts of the world.

The modern Eskimo used a fabricator consisting of a handle of walrus-ivory, with an attached working-point of antler or bone. The piece of stone to be worked was laid on a pad of hide in the left hand, or sometimes over a depression in a piece of wood, and with the right hand flakes were removed by downward pressure with the fabricator, which was moved along the edge of the stone as each chip was broken off. An essentially similar method is used by the aborigines of North-West Australia in the final process of shaping the delicate stone spear-heads to which reference has already been made; here also small flakes or chips are removed from the edges of a stone flake (first roughly shaped by percussion) by means of a pointed bone fabricator, a pad of bark being used, and downward pressure being exercised.

We do not know whether Stone Age man in Europe used such methods and tools, but it is probable that he did; small Neolithic implements of flint, with worn points, have been found which may perhaps have served the purpose of fabricators, and they are often given this name.

Implements, especially flake-implements, which have been finished by the removal of small flakes and chips are said to show *secondary working*, and the terms *re-touch* and *dressing* are also used in the same connection.

The Bulb of Percussion, etc.

When fractured by a blow, flint tends to break in such a way that the point at which the blow was struck is easily recognisable. A blow struck in the middle of a block of flint may break it so as to leave on one of the pieces a conical projection, the apex of the cone representing the point at which the blow was struck. This is the *cone of percussion*, and it is very rarely found on implements. *A bulb of percussion*, which is an incomplete cone of percussion, is found on flakes which have been struck from the surface of a piece of flint. If such a flake be examined, it will be found that at the end at which the blow was struck, and on the smooth surface of separation from the original block, there is a rounded swelling; the end of the flake next to the swelling, which is the bulb of percussion, is often flat, owing to the selection or provision of a plane surface on which to strike the blow; this is the *striking-platform*.

Bulbs of percussion vary in size, and they sometimes present an approach to a complete cone; occasionally, also, a flake may bear two or more bulbs side by side, as a result of an ineffective initial blow or blows which failed to separate the flake from the parent block.

There is sometimes a "scar" on the bulb, and narrow radiating fissures which diverge from the direction of the point of percussion. These are incidental to the flaking, and the fissures may serve to indicate the position of the bulb if this has been flaked away.

"Hinge fractures" are due to waves or ripples of fracture set up in the flint as it is struck, one of these "turning the corner" outwards at the distal end of the flake, giving this a smooth, rounded termination. "Plunging flakes" are due to the same cause, but in this case the fracture turns down into the core, a lump of which is brought away at the end of the flake.

Flint sometimes shows fractures which have been caused by natural agencies other than force. Frost-fracture and "starch-fracture" are of this nature, and can be readily identified, though they sometimes deceive the uninitiated.

A bulb of percussion on a flake is not conclusive evidence of human workmanship, since a naturally-produced blow, or even pressure under natural conditions, may give rise to a similar fracture. If, however, there is a flat area (striking-platform) on the end of the flake adjacent to the bulb, and one or more well defined ridges on the face of the flake, the probability of human origin approaches certainty. Great caution is necessary, however, in passing judgment not only on flakes, but even on some implement-like flints showing what appears to be secondary working. Up to the present, no general agreement has been

reached as to the exact features which distinguish human workmanship from the results of natural forces, and the views of experts differ (see p. 53).

The Forms of Flint Flakes.

Most of the flakes incidentally produced in the manufacture of Stone Age implements were of indeterminate form, though many of them were no doubt suitable for cutting purposes, or for making into arrow-heads or scrapers. In addition to these incidental flakes, there were others which were from the first intended for special purposes, and primitive man learned how to manipulate the flint so as to produce flakes of the size and shape he required. The long parallel-edged flakes, or blades, with one or more ridges on one face, are good examples of skill in flaking flint, and it is not till the later part of the Palæolithic Age that such flakes appear.

When struck off from a block or core a flint flake has always one face free from ridges, that, namely, which has separated from the block, and which bears the bulb of percussion. The other face may be part of the original crust of the block, or it may bear one or more ridges, which represent the lines along which previously detached flakes have separated. This face may also show indications of the hollow left by the bulb of percussion of a previous flake ("negative bulb"). The ridges on a flake have played a part in determining its length and shape, and part of the skill of the workman lay in striking his blows so as to take advantage of these and other features of the core. Blocks of flint have been found which have been shaped in such a way as to enable the flint-worker to strike off broad or long flakes as required (see the Palæolithic "tortoise-cores" of Northfleet, and the Neolithic "*livres de beurre*" of Pressigny).

The Finishing of Unpolished Flint Implements.

In the European Palæolithic Age stone implements were, as far as is known, never ground or polished, whereas some Neolithic implements were finished by these processes. Except in the case of celts, however, most Neolithic implements were finished by flaking and chipping, without subsequent grinding. In their symmetry of form and in the regularity with which the flakes have been removed, many Palæolithic implements are excellent examples of flint-working, and the Solutrian "leaf-shaped points" were made with a delicacy of finish which was scarcely surpassed in the Neolithic Age. The unpolished but finely-worked implements of the latter period (or in some instances of the Bronze Age) are, however, so numerous and widespread that there is no doubt that the art of flaking stone had made considerable advances.

In Denmark, in particular, large numbers of beautifully-worked celts, daggers, spear-heads, etc., have been found ; on some of the flint daggers the handle, which is in one piece with the blade, has been ornamented with a raised zig-zag line, produced by the skilful removal of minute chips of flint.

Egypt supplies us with the finest-known examples of flaked implements, the best of which date from before the beginning of the historical period (post-Neolithic) in that country. Many of the Egyptian knives show what is known as *parallel flaking*, which is also found on some European Neolithic implements, and is evidence of a high degree of skill ; a fine example is exhibited in this series.

Considerable importance attaches to the study of the details of the flaking of Palæolithic implements, since the style of the secondary working may be typical of the period when it was executed.

The Grinding and Polishing of Stone Implements.

Methods of grinding and polishing stone implements were apparently of later origin than the processes of battering, pecking, or flaking. In Europe, the hardness of the favourite material, flint, would delay or prevent the discovery that an implement might often be most easily finished by rubbing it on a suitable piece of rock. In many parts of the world, however, no flint or other similar stone has ever been available, and softer stones have often been used instead. Even though many of these were less serviceable than flint, they were more easily worked, and more readily lent themselves to grinding and polishing.

In addition to the polished stone implements of Neolithic Europe, comparable ancient or modern specimens are found in almost all parts of the habitable world, and they are made at the present day in parts of Australia, and in some islands of the Western Pacific.

Little need be said as to methods of grinding and polishing. A fixed grindstone, in the form of a slab of sandstone or other rock, has been widely used. The grinding was done by rubbing the implement on the grindstone, in some cases no doubt with the addition of water and sand. Such grindstones have been found in Europe, America, and elsewhere. Smaller portable grindstones and whetstones have also been widely used. The extreme degree of polish on some stone implements, both prehistoric and recent, is evidence of the great pains spent on the process. No doubt many were finished by rubbing with a piece of skin, with the aid of a fine polishing powder.

It may be that the grinding of stone implements was in the first case the result of the observation that flaked implements in frequent use acquired a polish, especially at the cutting edge, but

as we know nothing concerning the place or circumstances of the origin of the process, other views may be held. It is not improbable that the art of stone-grinding was only discovered and adopted as a standard practice at one time and place, and that the method spread from the original centre of discovery, gradually becoming known to practically all stone-age peoples; it is, however, not advisable to be dogmatic on such a point, especially as bone and antler were ground and smoothed in late Palæolithic times.

The Perforating and Cutting of Stone.

Owing to the hardness of flint, implements of this material were very rarely perforated. Many other kinds of stone are less resistant, however, and early man had invented means of making holes through axe-heads and hammer-heads, whilst implements of bone and antler were perforated as early as Upper Palæolithic times. The earliest perforated stone implements are those of the Neolithic (or perhaps Mesolithic) Age, and there is some uncertainty as to the methods by which the hole was produced. In some cases a process of pecking seems to have been employed; in others, a pointed piece of flint or other stone may have been used as a borer or drill. It is probable also that drills of wood or bone, twirled by hand and aided by sand and water, were employed in prehistoric times, as they have been found in use for this purpose in parts of America and elsewhere. Wood appears to serve the purpose better than bone, since the sand, which acts as the abrasive, becomes more easily embedded in a wooden working-point. In most cases the pecking or drilling was done from both sides of the stone, the two pits eventually meeting to form an hour-glass-shaped perforation. Evidence of the wide distribution of this method may be seen in the prehistoric and modern specimens exhibited.

Neolithic or Bronze Age stone implements have been found in which the hole, only partially bored, has in the centre a projecting core, the process evidently having been begun with a tubular instrument, worked by a rotary motion. Some of the finer pierced axe-heads of the Neolithic and Bronze Ages must have been perforated by means of tubes, but metal is not necessary for this purpose. Experiments have shown that a portion of an ox-horn, in combination with sand and water, will drill a circular groove with a central core; the core falls out when the circular groove reaches the other side of the stone, leaving a cylindrical perforation. A length of bamboo has been used for this purpose in recent days, in New Guinea, for perforating thick shell for armlets.

The cutting or sawing of stone was not often necessary, since most kinds of stone used for implements could be broken, and flaked and ground into shape. Where cutting was practised on

stone difficult to break, as on nephrite by the Maori of New Zealand, simple methods involving much time and patience were adopted; the usual tool was a slice of sandstone or other rock, sometimes hafted, and used in the manner of a saw, with the aid of water and sand.

The Use of Stone other than Flint.

Although flint, when obtainable, has at all periods been a favourite material for making into implements, other kinds of stone have been widely used. In regions where flint does not occur, as in a large part of Oceania, other materials were of necessity employed. It is only possible to indicate briefly some of the kinds that have been most widely used. Many of them are siliceous in composition, and allied to flint; others are of volcanic or igneous origin. Quartz, jasper, agate, chalcedony, carnelian, quartzite, obsidian, basalt, serpentine, jade, jadeite, hornstone, diorite, and granite are amongst the harder rocks that have been made into implements, whilst even the softer sedimentary rocks, such as shale, slate, and sandstone, have been turned to account in various ways.

Most of the above-mentioned stones are less easily flaked than flint, though obsidian has similar qualities. Quartzite is particularly refractory, and the flaking is difficult to control. Granite cannot be said to flake at all, and the shaping has to be done in the first case by breaking off large pieces, and then further reducing by a "pecking" process which crushes the surface and so removes small fragments at a time. The differences in the qualities of various kinds of stone must be borne in mind when drawing comparisons between the implements made of them; the flint-worker had an easier task than the worker in quartzite, for example, and was more likely to produce finely-finished implements.

In some islands of coral origin not only is flint absent, but stone of any kind suitable for implements is unobtainable. In these cases, as in the Caroline Islands in the Pacific, recourse was had to sea-shells, the larger of which (such as the Giant Clam), supplied material for axe-heads and adze-heads.

Patination and other changes undergone by Flint Implements.

The blocks or nodules of flint found in their natural position in the chalk are white on the surface, and grey, brown, or nearly black in the interior. The white external layer persists after all the chalk has been removed from it by means of an acid, and is found to owe its appearance to a modification in the nature of the flint—not to a deposit of chalk. This crust, or cortex, is usually flaked away in the making of implements, but portions are often left untouched.

Most flint implements, which originally showed the natural colour of the flint of which they were made, have in the course of many years' exposure, become altered in colour and surface texture. Some implements, for example, are now white on the surface, and to a varying depth, this being the result of exposure to chemical agents in the soil and atmosphere. The presence of chalk in the soil appears to favour the whitening of surface flints. The blue colour often seen is due to an incipient film of white, which affects the tint of the underlying black interior, often with an effect of mottling.

It is probable that the whitening of flint, which indicates that it has become externally more porous, was a usual, and perhaps an essential, preliminary to the staining so often found. Yellow, brown, and ochreous flints are frequently met with, usually in cases where the implements must be referred to Palæolithic times, but the causes which produce the colouration are not fully understood ; there is evidence that iron plays a part in the process. Some implements of great antiquity present almost the appearance of freshly-fractured flint from the chalk, and it is probable that these were buried soon after they were made, in a non-chalky soil, without any long period of exposure ; or that they were protected from the weather in a cave or rock-shelter.

The lustre on the surface of implements is probably due, in most cases, to friction, either by slow movement of the soil in which they were embedded, by running water carrying sand or other hard particles, or by wind-borne sand in the case of desert specimens. The extremely brilliant surface of some flints, such as many from Knowle Farm gravel-pit, in Wiltshire, is by some authorities believed to be due to a glaze consisting of a secondary deposit of silica. Others believe it to be a polish of mechanical origin, but this seems less probable, since the gloss extends over the rough cortex of some of the flints ; but Egypt has provided many examples of highly lustrous flints, and in some at least of these, the condition appears to be due to sand-polishing.

The altered surface-layer of flint implements is often spoken of as the *patina*, and the flint is said to be *patinated*. The nature and degree of patination may afford valuable evidence as to the antiquity and genuineness of an implement, though patination is not a safe test of age. On the whole, however, Palæolithic river-drift implements are much more often deeply stained than those of later times.

Some interesting examples of the variation in patination, caused by what appear to be only slight differences in exposure, have been found in Egypt and elsewhere. For example, the two halves of a broken implement have been found quite near to each other, but showing very different degrees of patination ; and in other cases, the upper exposed surface of an implement

found lying on the sand is very different in condition from the under, protected surface.

Implements, both of flint and other kinds of stone, often give indications of having been subjected to prolonged friction, in part at least against the rock and gravel in the bed of a stream or torrent. In these cases the sharp edges and the margins of flake-scars are rubbed down, and the whole implement presents a characteristic "water-worn" appearance. This attrition has sometimes gone so far that the implement has become pebble-like, little or no indications of flake-scars being left.

Flint implements occasionally show scratches, or striæ, supposed to be due to the action of moving masses of ice, in grinding the implements against rocks and stones capable of scratching flint. Striæ have no doubt in some cases been produced on implements in this way, but not all scratches are glacial striæ, since flint may be scratched by other means and processes.

Flint is not the only kind of stone that is liable to a surface change that may be called patination, and in some cases the effect produced is a disintegration of the stone.

SOME MATERIALS OTHER THAN STONE OR METAL USED FOR TOOLS AND WEAPONS.

It has already been mentioned that the men of the European Stone Age did not confine themselves to stone for the raw material of their tools and weapons. The harder parts of animals and plants were also employed. Wood was no doubt the most valuable of these materials, serving for handles and shafts, as well as for clubs, but very few remains of wooden implements or parts of implements have survived. These are mostly no older than the Neolithic Age, though Palæolithic man no doubt made use of wood, which was probably in use as early as stone, perhaps for digging-sticks, spears, and clubs. In the Upper Palæolithic Age, bone and ivory were employed for spear-heads and other purposes, and Neolithic man also used bone and antler.

The more modern implements from Oceania, from America, and elsewhere, illustrate the ingenuity of man in making the most of the materials at his disposal. Amongst these may be mentioned :—the sharks' teeth weapons from the Pacific Islands, the mother-of-pearl and turtle-shell fish-hooks also from the Pacific, the arrows with cassowary-claw points from New Guinea, the bone-pointed, or bone-barbed, arrows from New Guinea and elsewhere, the East African spears pointed with the horn of an antelope, the shell adze-heads from the West Indies, and the bamboo knives from New Guinea ; spears, arrows, and clubs of various kinds of wood are practically universal in their distribution. The extensive use of bone and ivory for clubs, spear-heads, arrow-heads, knives and many other implements, is best illustrated by the tools and weapons of the modern Eskimo.

Since errors are often made in the names of certain materials referred to above, and of some others, it may be permissible to point out the commonest mistakes. Perhaps the most prevalent, especially amongst archæologists, is the use of the word "horn" for the antler of a deer, or reindeer, and for the material of which it is composed; an antler is not a horn, and it consists of bone—hard bone—not of horn. The horn of an ox or a buffalo, on the other hand, is a true horn and it consists of horn. Also of horn are the claws of birds and beasts, turtle-shell, and whalebone. Turtle-shell is unfortunately almost always called tortoise-shell (which it is not), whilst whalebone is frequently confused with whale's bone. Whalebone is from the mouth of the whalebone whale, where it occurs in the form of plates of horn, of essential importance in the filtering process by which the animal obtains the large quantities of small organisms on which it feeds; whilst whale's bone is bone from the skeleton of any kind of whale. As regards ivory, this is obtained most abundantly from the tusks of elephants, but other sources are the teeth of the sperm-whale, the tusks of the walrus, and the tusks or teeth of some other large mammals.

There is no special series to illustrate the use of the above-mentioned materials, since numerous examples will be found in the adjacent cases of tools, and amongst the weapons in the hall below.

Geological Periods			Stone Age Periods	Sub Divisions	Beginning about B C	Types of Man
QUATERNARY	Holocene or Recent	Post Glacial	NEOLITHIC AGE		2500	Mediterranean, Alpine, and Nordic
			MESOLITHIC AGE	Campignian, Maglemosian, Azilio-Tardenoisian	6500	Ofnet and Furfooz
	PLEISTOCENE	Würm Glacial	UPPER PALÆOLITHIC AGE	Magdalenian, Solutrian, Aurignacian	9000 / 12000	Chancelade, Cro-Magnon, and Combe Capelle, etc.
		Riss-Würm Intergl	MIDDLE PALÆOLITHIC AGE	Mousterian	25000	Neandertal and allied types
		Riss Glacial		Levalloisian (late), Acheulian (late), Clactonian (late)		
		Mindel-Riss Intergl.	LOWER PALÆOLITHIC AGE	Levalloisian (early)		
		Mindel Glacial		Acheulian (early)		Heidelberg*
		Günz-Mindel Intergl		Clactonian (early)		Piltdown*
		Günz Glacial		Chellian		(In Asia :— Peking and Java)
			EOLITHS	Pre-Crag, Kent Plateau, etc.	"500,000"	
TERTIARY	Pliocene, Miocene, Oligocene, Eocene					

*The positions of Heidelberg man and Piltdown Man are uncertain.

CHRONOLOGICAL SERIES

THE STONE AGE IN EUROPE

The foregoing may serve as an introduction to the study of implements of the Stone Age; in the pages which follow, the subject will be pursued in relation to the distribution in time of the Stone Age cultures and their developments. The estimates of time given in the adjacent table are intended to give an idea of the duration of periods, but such estimates have no claim to finality. The relationships of the Lower Palæolithic cultures to the phases of the Glacial Period, as given in the table, are also provisional; the correlations represent a simplified interpretation of investigations of the varied deposits of the Somme valley. The river-gravels and glacial deposits of our own country present greater difficulties, but by co-operation between archæologists and geologists, great advances are being made.

The differences of opinion as to the positions of the Lower Palæolithic cultures within the framework of the Glacial Period cannot be discussed here, but it should be mentioned that the Chellian is often placed in the Mindel-Riss Inter-glacial, with a resulting compression of the post-Chellian cultures into a shorter period.

Case 5) PRE-PALÆOLITHIC FLINTS.

The problem as to the origin of the flaking and chipping on the flints which are usually included in the ill-defined category of "eoliths" cannot be regarded as finally settled one way or the other, and it is necessary to touch briefly on this vexed question before entering on a description of the universally-recognised products of the Stone Age.

Space will not permit of a discussion of the geological evidence bearing upon the antiquity of the pre-Palæolithic flints. Many come from the south and east of England, and from France and Belgium, occurring in positions which they must have reached at a very remote period. Amongst them are the Kentish eoliths ("Harrisonian eoliths"), which are flint pebbles, now of a deep ochreous colour, from which small flakes have been removed along one or more edges. The pebble is often (naturally) split in such a way that one face is flat, and the chipping on the edges has evidently been caused mainly by vertical pressure or blows. Their period is regarded as late Pliocene or early Pleistocene, and similar types have been found elsewhere in this country.

Human workmanship has been vigorously claimed, and widely admitted, for certain flints to which the term "rostro-carinate implements" has been applied. These are found mainly below the Red Crag (East Anglia) in the "Bone Bed," which is regarded

as a Pliocene deposit.* Other chipped flints are found in the same and other early deposits in Norfolk and Suffolk. Of even greater antiquity are the chipped flints of Thenay in France, which were found in Oligocene deposits, whilst those of Le Puy-Courny are of Miocene Age ; but there are probably few, even amongst the most enthusiastic believers in Pliocene man, who would pin their faith to these pre-Pliocene flints.

The controversies concerning eoliths and comparable flints have centred mainly round the question as to whether the chipping has been produced by natural causes, or is the work of man or an immediate precursor. The possibility that the latter is the correct view, as regards some types, is widely acknowledged, but to many archæologists the evidence for a definite conclusion seems inadequate.

Some authorities reject all " eoliths," and what is advertised as the work of man by one group of disputants is stigmatised with equal confidence as the work of nature by another.

It has been pointed out that flints churned together in water running at about the average rate of a river in flood may be battered into shapes resembling those of many eoliths, and evidence has been adduced to show that eolithic forms are produced by pressure similar to that to which flints may be subjected under ground, during slow earth-movements. It should be noted, however, that methods of experiment, results, observations, and interpretations, are all refused acceptance by the believers in eoliths.

It cannot be doubted that many natural flints are regarded as implements by the uncritical and by the over-enthusiastic, whilst other observers are led astray by a selective bias. It is, however, neither scientific nor expedient to reject the claims of all doubtful flints, without consideration. The earliest implements of man were no doubt such stones as came to hand, and even though they might become chipped and bruised during use, it is more than doubtful whether we should now be able to recognise that they had served as implements ; a similar difficulty would occur in the case of the earliest and rudest artificially-shaped implements.

Some eoliths may be naturally-shaped stones utilised by early man, and others may be his crudely-formed tools, but the existence of definite pre-Palæolithic culture-stages cannot be said to have been conclusively demonstrated, either in England or on the continent. Nor can it be asserted, on the evidence of the East Anglian flints, that man was making tools or weapons in Western Europe during Pliocene or pre-glacial times.

*The dividing line between the Pliocene and Pleistocene deposits in this country has not been established with finality, but the present tendency is to place it (in East Anglia) below the Red Crag.

There is nothing far-fetched in such a view, which is held by many archæologists, especially on the basis of the rostro-carinates and other sub-crag flints ; but the issue can never be settled by individual declarations of faith in the human origin of chipping which, at the best, is on the border-line between the natural and the artificial, and which can be parallelled on flints which were admittedly shaped by natural agencies. In any case, however, man must have been evolving during Pliocene times, though not necessarily in East Anglia.

The East Anglian flints to which reference has been made, have been classified into " cultures," which have been given the names of Icenian, Darmsdenian, and Pre-Chellian. Older than any of these are said to be the flints similar to the eoliths of the Kentish Plateau. The rostro-carinates belong to the Pre-Chellian group, and the precarious suggestion has been made that from this form arose the hand-axe of Chellian times.

It has been proposed that the term eolith should be restricted to those types which fall into the group to which the name was first applied—the Kentish eoliths. It is unlikely, however, that the use of the term in a general sense will be abandoned by those to whom it serves as a convenient expression of suspicion or repudiation.

It may be noted that the chipped stones found in association with the remains of " Peking man " (*Sinanthropus*) in China (see p. 53) have a bearing on the question as to the stage at which early man is likely to have got so far as the working of stone. *Sinanthropus* was lower in type than any of the early men whose remains have been found in Europe, and if he made the crude implements that have been assigned to him, it would be in no way surprising if a Pliocene ape-man in Europe was at a comparable stage in the art of flint-working. But up to the present no human, or sub-human, remains have been found in Europe in association with " eoliths " of any kind.

The finding in East Africa (Uganda, Kenya) of flaked stones, in very early deposits, which have been compared with some of the East Anglian flints, and have, indeed, been tentatively assigned to the same period, may also be taken into consideration. The terms Kafuan, Oldowan, and Uganda Cromerian, have been given to the cultures which are believed to be represented by these stones (see p. 86).

Cases 6–18) THE PALÆOLITHIC AGE.

That the characteristic flaked stones of the Palæolithic Age were worked and used by man is now universally acknowledged. They could only have been produced by intelligent and skilful manipulation, with a definite form in view. They are found chiefly in river-deposits, associated with existing river-basins,

sometimes in glacial deposits, and also buried in caves and rock-shelters ; in some instances, as at Caddington, near Dunstable, large numbers of finished and unfinished implements, cores, flakes, and hammer-stones, have been found within a small area on an old land surface now buried several feet below the present level. These " Palæolithic floors " represent sites where the manufacture of flint implements was carried on.

The implements found in the river-deposits, and less generally elsewhere, are the work of the men of Lower Palæolithic times (River-drift Period). The implements are at least as old as the beds in which they lie, since the flaked surfaces are coloured like the unworked flints in the same beds, and in many cases the implements have been rolled and abraded previous to their deposition. The teeth and bones of animals long since extinct are often found in association with them, and it is establish-lished that Palæolithic man lived amongst an assemblage of wild animals very unlike that now found in Europe.

In addition to the implements occurring in the sands and gravels of the river deposits, many caves and rock-shelters have been found to contain Palæolithic implements, in the main of other types, usually associated with the remains of animals, and even of man himself.

The relics of the men of this remote period have been discovered in great abundance in England and France, and the evidences of man's presence are widely distributed in Central and Southern Europe—not in the north, however. In England they are of relatively rare occurrence to the north of a line joining the Wash and the Bristol Channel, though Derbyshire has yielded relics of cave-man, and other Palæolithic implements have been found in Yorkshire, Warwickshire, Lincolnshire, and Wales. Most of the implements from Scotland and Ireland are Neolithic, though the Mesolithic Age is also represented.

In connection with the question of the antiquity of Palæolithic implements, it is necessary to touch upon those remarkable changes constituting the Great Ice Age, or *Glacial Period*, which was the outstanding climatic feature of the Pleistocene Period, and which affords explanations of the restricted distribution of Palæolithic implements in Europe.

The Glacial Period.

About the end of the Tertiary Period the climate of Europe, which was then tropical, or at least very warm, changed to temperate, and then became colder still, until arctic conditions prevailed, especially in the North. In the neighbourhood of the great mountain ranges also, such as the Alps, glaciers issued far down the valleys. After the first onset of the cold, warmer conditions

again prevailed, and there were fluctuations of climate for many thousands of years, glacial conditions alternating with warm or temperate inter-glacial stages.

During part of the Ice Age, the British Isles had a greater extension than at present, and were joined to the Continent of Europe, whilst at times much of the land north of the Thames was under ice. Scandinavia and Northern Europe appear to have been under glaciers or ice-sheets for practically the whole of the Ice Age, and this may have been the case with a large part of our own islands. Farther south, on the continent, evidence has been found to show, especially by a study of the glaciers of the Alps, that there were several—three, or four, according to the authority accepted—periods of maximum cold, alternating with phases of less severity, though not necessarily very warm.

To the four glacial, or cold, phases, have been given the names of Günz, Mindel, Riss and Würm (after Alpine rivers), the Günz being the most remote from our own time, and, according to some geologists, the Würm being by far the most severe. The three relatively warm inter-glacial phases are expressed by the terms Günz-Mindel, Mindel-Riss, Riss-Würm. British geologists are not all agreed that this series of great fluctuations is traceable in the geological deposits of this country, though there is no dispute as to the influence of the Glacial Period as a whole, and recent work in East Anglia suggests the existence of four distinct groups of glacial deposits.

The question as to whether man lived in Europe before, or during, the Ice Age, was formerly much debated, but it is now certain that he was here probably during the greater part of it; according to some archæologists he was here—or a tool-making ancestor was here—before it began. The Palæolithic Age and the Glacial Period may be said to end at the same time.

Many estimates of the length of the Palæolithic Age have been put forward, and there is perhaps no harm in mentioning a figure of 500,000 years, as an indication that it began a very long time ago.

Sub-division of the Palæolithic Age.

The Palæolithic Age is often divided into the *River-drift Period*, characterised chiefly by the implements found in the river-gravels, and the *Cave Period* (see Table, p. 32). *Lower Palæolithic*, *Middle Palæolithic*, and *Upper Palæolithic*, are terms now in greater favour, whilst the minor sub-divisions of stages of culture are based on the close study of the implements, and on the other evidencies of the activities of Palæolithic man. In the Museum cases a special series has been arranged to give a summary view of the basis of classification, as determined by the succession of types of implements (see Case 7).

In this Handbook the terms River-drift Period and Cave Period will often be used for convenience, though Lower, Middle, and Upper Palæolithic are more scientific. In Europe, the Lower and Middle Palæolithic were characterised by ancient types of man, whilst modern types (*Homo sapiens*) appear in the Upper Palæolithic, beginning with the Aurignacian. For this reason, *Palæanthropic* is a term sometimes used for the pre-Aurignacian period, and *Neanthropic* for post-Mousterian times. Recent work in Africa (Kenya and Rhodesia) suggests that, in this region, modern man was contemporary with an ancient type of man who made implements such as have been assigned to the Levalloisian and Mousterian cultures. Whether or not this was Neandertal man, or an allied form, must remain uncertain until his bones have been found.

The Lower Palæolithic or River-drift Period.

Cases 7–13)

The implements of the River-drift Period are of relatively few well-defined types, though they are sufficient to indicate that the men of this time were already skilful in the working of flint, which was the material chiefly used in Europe. The characteristic form is the *coup-de-poing*, or hand-axe (see p. 13). In this implement—tool or weapon, or both—a portion of the original crust of the flint block may often be seen at the butt-end, but usually the greater part of the implement shows facets where flakes and chips have been removed. There is considerable variation in the shape and size of this type, and the older ones differ in various respects from those of later times. The cruder and heavier would be almost certainly used in the hand without any haft, and it may be that not any of them were hafted. The cleaver (see p. 14) may be regarded as a variety of the hand-axe (Plate I).

A well-known type of the later part of the River-drift Period is the sharp-rimmed implement with oval or ovate outline. These are often thin and finely-shaped, and it is not improbable that this form was attached to a haft and used as an axe, or provided with a grip of skin or flexible twigs, and used as a knife. Some " ovates " have a symmetrical twist on their long axis (" screw ovates "), produced in the flaking of the implement, but the significance of this feature is not known.

Amongst other forms of flint implement may be mentioned : chopping-tools with thick back, knives, scrapers, discs, and hammer-stones ; the concave scraper is represented by notched flakes, or by other implements with notches. The tools made from flakes are now many of them assigned to the Clactonian and Levalloisian industries (see below, p. 39), and it has been suggested that core-implements and flake-implements were characteristic of two independent cultural developments, of southern and eastern origin respectively.

Many of the specimens exhibited are from the old Thames gravels that have been worked for commercial purposes near Northfleet, in Kent. They occur at various depths in the terrace now lying at 90 to 100 feet above the level of the river, which has cut down its valley to this extent since the gravels were deposited, at a time when the implements were made, and lost or discarded, by our remote predecessors in the Thames valley.

Other localities represented in the cases are Aylesford (Kent), Maidenhead, Dunbridge (Hants.), Warren Hill and Mildenhall. (Suffolk),Kempston (Beds.), Knowle (Wilts.), and Broom (Devon).

There are also specimens from St. Acheul, in France, a site which is classical in prehistoric archæology, and which gives its name to the last major phase of the River-drift Period.

Two well-marked stages can be recognised in the River-drift Period, though it is believed that the later developed from the earlier. *(See also Flake-industries, below.)*

In the earlier, the **Chellian,** the implements were roughly shaped, and the flaking of the edges of the hand-axes was not fine enough to produce an even outline. In the later, or **Acheulian,** these implements were better shaped and finished, and the still more finely formed type, the ovate sharp-rimmed implement, was evolved.

The flakes that were produced in the making of the Chellian implements were large, broad, and conchoidal, usually leaving strongly-marked concavities on the surface of the implement. The Acheulian flint-workers were more skilful, and the flakes they struck off were longer, narrower, and finer, though still usually conchoidal. It has recently been suggested, and supported by experiments in flint-flaking, that this greater skill was associated with, and perhaps dependent upon, the use of a cylindrical wooden mallet as a flaking-tool; but no such tools have been or are likely to be found.

The Chellian culture-stage fell within a warmer interval of the Ice Age, the Günz-Mindel Interglacial, according to some authorities, a later one according to others. The Acheulian occupied a large part of the succeeding Interglacial, and if this was the Mindel-Riss, the Acheulian persisted through the Riss Glacial until towards the end of the Riss-Würm Interglacial, when the climate was again becoming colder.

Flake-Industries.

The Clactonian. Considerable importance is attached to the difference between industries in which most of the implements are made from blocks, or cores, of stone, and those in which flake-implements predominate. Most (but by no means all) hand-axes and ovates are core-implements, and until recently the Mousterian was regarded as the earliest well-characterised flake-industry.

Two still earlier flake-industries, allied to each other and to the Mousterian, are now recognised. The oldest, the Clactonian, so-named because it was first identified at Clacton-on-Sea (Essex), appears to be mainly post-Chellian, and to persist alongside the Acheulian and the Levalloisian (the second flake-industry) for a long period. It seems possible that it arose out of the utilisation of flakes struck off in the shaping of Chellian hand-axes.

The Clactonian is represented in the cases by implements from the 100 ft. terrace of the Thames at Swanscombe, Kent. The cores from which the flakes have been struck often present the appearance of chopping-tools, and perhaps they were sometimes used for such a purpose. The flakes themselves usually have a flat striking-platform, which is at a large angle with the plane of the flake, and the bulb of percussion is conspicuous. The amount of secondary work varies, and there is sometimes an approach to Mousterian technique. Most of the implements are suitable for use in scraping and cutting, though some might be described as borers.

The Levalloisian. This is named from a site in France ; it makes its appearance early in Acheulian times, and persists over approximately the same period. It has been suggested that interaction between the techniques of the Acheulian and the Levalloisian stone-workers gave rise to the Aurignacian technique, but at present the idea must be regarded as speculative.

The Levalloisian flakes were obtained from cores, sometimes of considerable size, which were shaped in advance so as to yield flakes of a desired size and form. Owing to their shape these are often called " tortoise cores," whilst the flakes are characterised by a striking-platform which shows the flake-scars produced in the preliminary shaping of the core. The flakes are, therefore, said to have a " faceted butt," and this is a characteristic feature of the industry, though it is found also on some Mousterian implements. When the flakes are broad they often closely resemble ovate implements, though they differ from these in having one face—the bulbar face—smooth and unworked. Some Levalloisian implements are made from narrow flakes, and may then be very similar to Mousterian points. After the flakes were struck off the core they were often finished by a little secondary working, usually on one face only.

Specimens from " Baker's Hole," Northfleet (Kent), both cores and flakes, are exhibited.

The Mousterian. Since views on the inter-relationships of this industry with the preceding two, are not yet fixed, it is probably advisable to continue to regard the Mousterian as being the only industry of the Middle Palæolithic Age (see below, p. 43), until such time as it is possible to disentangle those Clactonian

and Levalloisian industries that have hitherto been wrongly assigned to the Mousterian. This has already been done in some instances ; for example, the Levalloisian implements of Baker's Hole, and the advanced Clactonian of High Lodge (Suffolk), were formerly regarded as Mousterian.

The Mousterian may, therefore, be still accepted, provisionally at least, as a cave-culture (perhaps of limited distribution), belonging mainly to the earlier part of the Würm glacial phase, whereas both the Clactonian and the Levalloisian are earlier in origin, and are not cave-cultures. It has been suggested that the Mousterian was a derivative of the Clactonian, with a transitional stage that has been called the Tayacian.

It must be borne in mind that the three flake-industries just discussed are not the only ones, since the cultures of the Upper Palæolithic also come within this category, though the flakes, or blades, of these later times were often parallel-sided. It has been suggested that the stone-working of these later cultures may be conveniently styled " blade-and-burin " industries.

Middle and Upper Palæolithic Periods.

Cases 14–17)

The Cave Period.

The implements and other relics of the later Palæolithic peoples have been discovered in great abundance in caves in England, Belgium, Spain, and especially France. The succession in time of a well-marked series of culture-stages has been established, the names given to these stages being derived from those of caves and rock-shelters in France. It is generally agreed that the Cave Period was contemporaneous in the main with the onset and decline of the last cold phase (the Würm) of the Ice Age, and Mousterian man may have been driven to live in caves in order to escape the rigours of an open-air life ; the climate improved in Aurignacian times, when steppe conditions prevailed over a wide area, only to deteriorate to the arctic conditions under which the Magdalenians lived. Afterwards it steadily became more temperate, until present-day conditions were approached. It should be noted, therefore, that even during the decline of the last glacial phase there were minor fluctuations in climate, though the changes in temperature were not sufficient to produce the contrasts which characterised the major glacial and inter-glacial phases of the Ice Age.

It is largely by the study of the animals of the various periods that the nature of the climate is determined, though the characters of the geological deposits, and of the implements of the cave-men, supply important data.

Before discussing the sub-divisions of the Cave Period, a few general observations may be made on the subject of the caves of Britain and France.

The Caves of England and Wales.

Many limestone caverns in England and Wales were used as living-places or as temporary shelters, not only by Palæolithic man, but also occasionally by his successors down to comparatively recent times. Implements which are mainly of Upper Palæolithic types have been found buried in the floors of the caves, and are often mingled with the bones of extinct animals. Amongst the remains found are bones of the mammoth, reindeer, woolly rhinoceros, cave-bear, hyæna, and the wild horse. Some of the teeth and bones belonged to animals which inhabited the caves at one time or another, whilst others represent prey brought in for food, in many cases no doubt by human occupants. The implements and bones are found embedded in deposits lying at some distance below the present level of the cave floors, the overlying deposits comprising such materials as blocks of limestone, black mould, stalagmite, and clay.

In a limestone cave at Creswell Crags (Derbyshire) an engraving of a horse's head on bone has been found, this being the best example from England of the style of art which was so highly developed in France during the later part of the Cave Period. Poorer examples have also been found at Creswell Crags.

Amongst the best-known of the British caves that have afforded Palæolithic remains are: Kent's Cavern (Devonshire); the "Hyæna-Den" at Wookey Hole, Aveline's Hole, and Gough's Cave (Somerset); various caves in Creswell Crags (Derbyshire); and Paviland Cave (Gower, South Wales). In most cases it is the Aurignacian phase that is predominant, though the Mousterian, the Solutrian, and the Magdalenian are also represented, sometimes rather inconclusively.

A few teeth, bones, and flint flakes from some of the above caves, are exhibited.

The Cave Period is also represented in this country by a relatively small number of finds of implements which, judged by form and workmanship, belong to one or other of its divisions, but which occur in the open, more or less deeply buried. The sites are mainly in South-eastern Britain, where there are no caves.

The Caves of France.

The Palæolithic cave-dwellings and rock-shelters of France have afforded an extraordinary quantity of evidence as to the culture and habits of early man. By the careful investigation of the stratified deposits, and comparison of finds from various sites, it has been possible to make reliable deductions as to the relation to each other in time of the various classes of implements and other relics that have come to light. The changes in the technique of flint-working have been studied, the development of art has

been traced, and skeletal remains of various types of man have been identified. Beginning with the *Mousterian* stage, when flake-implements became predominant, the story passes through the *Aurignacian* stage, when bone and ivory were coming into frequent use, and skill in realistic art was already well-developed, to the *Solutrian*, noteworthy for highly finished products of flint-working, unequalled in any other phase of the Palæolithic Age. On this follows the *Magdalenian* stage, especially characterised by the great development of the use of bone and reindeer-antler, and by the numerous carvings and cave wall-paintings of the animals of the period.

Specimens from a number of the French caves are exhibited.

The Middle Palæolithic Period.

Cases 14–15)

The Mousterian stage: The name is derived from the cave of Le Moustier, in the Dordogne, France. The characteristic implements were made from flakes of flint, finished by chipping along the edge or edges of one face only. To this class belong chopping or cutting tools, side-scrapers or *racloirs*, and points. Mousterian flakes and flake-implements often show facets on the butt, this being evidence of the use of blocks of flint specially shaped to give flakes of required size and shape (as in the case of the above-mentioned tortoise-cores). This was, however, even more characteristic of the Levalloisian industry. The late Mousterian style of " dressing " flakes was by a " stepped" retouch, the chips removed being short and scale-like. The use of bone for implements appears to have scarcely begun.

The climate was very cold for the greater part of the Mousterian stage (the Würm glacial phase); less severe conditions appear to have prevailed during the early part of it, however. The fauna was mainly that which would be associated with tundra conditions, and included the mammoth, woolly rhinoceros, reindeer, arctic fox, musk-ox, and the cave-bear. The men themselves were of the type best known as Neandertal man, who was characterised by a number of ape-like features, and is regarded as sufficiently distinctive to be placed in a separate species (*Homo neandertalensis*, see p. 52). It is probable that Neandertal man died out or was exterminated by his successors. No parts of the skeleton of this type of man have as yet been found in Britain. The occurrence of skulls of Neandertal type at Gibraltar, in Italy, as well as in other parts of Europe, must be noted. A comparable culture of North Africa, which presents special features, is called Aterian. At present the terms Mousterian, and Mousterian man, must be regarded as provisional, whilst even " Middle Palæolithic " is losing in definition.

The Upper Palæolithic Period.

Cases 15–17)

In the Upper Palæolithic deposits there are no longer found the remains of the Neandertal type of man, but those of men of our own kind (*Homo sapiens*), with evidence that more than one race was present in Western Europe. There are, moreover, indications of the movements of peoples, and the Aurignacians, with whom the period opens, were probably immigrants from Asia, though not as a cultural unit, or all at one time. There is in Europe, therefore, a definite break in continuity, both in culture and in the human types, between Mousterian and Aurignacian times (from Palæanthropic to Neanthropic). A similar break has been proved elsewhere (Palestine).

The Aurignacian stage: This stage is named after the type station of Aurignac, a cave in the Haute-Garonne. Characteristic flint implements are the flake-knives (with secondary chipping along one edge), end-scrapers or *grattoirs*, and keeled scrapers; in the secondary-working the small flakes were often struck off in such a way as to produce a characteristic channelling of the margins. Bone points split at the base are also typical, though their exact use is difficult to determine. Flint gravers, or *burins* are common, and it is generally believed that one of their uses was in the production of the sculptured and engraved figures of the period.

The older of the remarkable paintings and engravings on the walls of the caves have been assigned to the Aurignacians, who are also credited with small statuettes in ivory. Aurignacian sites in Britain are Creswell Crags (various caves) in Derbyshire, and the Paviland Cave in Gower, South Wales, whilst "floors" in the open have been recorded. The Upper Aurignacian of Creswell Crags is a specialised development, perhaps with Magdalenian influence, and it has been called Creswellian. The Aurignacian has been traced all over Central and Western Europe, though not as a uniform culture. There has been much controversy as to the origins and inter-relationships of the three phases (Lower, Middle, and Upper) which are recognised.

The climate was cold and dry. Remains of the mammoth and the woolly rhinoceros are found in the earlier deposits, but the horse was the characteristic Aurignacian animal, and steppe conditions were probably widespread; wind-blown deposits (löss) have yielded Aurignacian implements. From the skeletons and skulls that have been found, it has been determined that in Aurignacian times there were men of more than one variety or type of *Homo sapiens* in Western Europe; some of the remains have been assigned to the race which is usually called that of Cro-Magnon (after a site in the Dordogne), characterised by broad face and long head (dysharmonic), and by tall stature, whilst

others are of types represented by remains from Combe Capelle and Grimaldi (Mentone), respectively.

The Solutrian stage: This is named after a village (Solutré) near Mâcon, Saône-et-Loire. During this stage the art of flint-working reached a level which was scarcely surpassed even in the Neolithic Age, though the number of fine Solutrian implements is insignificant compared with the great numbers of Neolithic specimens that are known. Bone-working was little practised. Leaf-shaped flint points and blades, beautifully worked on both faces, are typical, and they possibly served as the heads of spears as well as knives. Such implements are characterised by a "scaly" retouch, thin flakes being removed over the whole surface, probably by pressure. The characteristic "shouldered points" are similarly worked, but scrapers and borers are of ordinary types, with edge-chipping.

A number of Solutrian blades have been found in Britain, two of them in a Somersetshire cave, others in East Anglia. To some of the cruder types of blades or points, the term *Proto-Solutrian* has been applied.

The Solutrians were intruders—perhaps enterprising hunting tribes—into Western Europe from the east (? Hungary), and they interrupted for a time, and possibly influenced, the local evolution of the Aurignacian culture into the Magdalenian of France.

The climate appears to have been deteriorating again, and the tundra animals were returning. Of the type of man little is certainly known, and he appears to have had only a limited distribution in Europe.

The Magdalenian stage: The rock shelter of La Madeleine, near Tursac (Dordogne), gives the name to this stage. Flint-working was now in a state of decline, being subsidiary to the working of bone and antler. There are indications that the Magdalenians were partly at least of the same stock as the Aurignacians, and that their culture developed in the West, perhaps in the south of France, but this cannot be regarded as proven. Outside France, however, few indications of the Magdalenians are to be found.

The flint implements include long flake-knives, long scrapers, borers, and gravers, all made from flakes, and finished with a "nibbling" retouch; the workmanship is in no way comparable with that of the Solutrians.

Bone and antler were made into the heads of spears and harpoons, together with awls or piercers, and delicate needles with eyes for the thread (probably sinew). The harpoon-heads, which present some range of variation in their details of form, play an important part in the sub-dividing of the Magdalenian stage.

Very interesting are the long, and often decoratively carved pieces of reindeer-antler with one or more perforations, which have been the subject of considerable controversy; some of them, at least, are probably straighteners for the shafts of spears and harpoons, and simple forms of them were made in Aurignacian times. The modern Eskimo use perforated bone tools for the same purpose.

The spear-throwers made of reindeer-antler, and often decorated with carvings of animals, are also of great interest, especially for comparison with the wooden spear-throwers used in recent times by the Australian aborigines, the Eskimo, and others.

The art of carving and engraving representations of animals in bone and ivory reached its highest level of excellence in the Magdalenian stage; the engravings indeed are practically confined to this period, and they represent the final development of this form of Palæolithic art. Most of the finer cave-paintings also belong to this period.

The climate was cold, although the Magdalenians lived on this side of the climax of the last glacial (Würm) maximum. They witnessed the last of the severe minor cold phases (the Bühl) that interrupted the amelioration of climate which ultimately led to the establishment of the existing temperate conditions in Western Europe. The Magdalenian hunters chased the bison and the reindeer, amongst other animals, but the mammoth was becoming scarcer, at any rate in France. Relics of Magdalenian man have been found in Britain, but they are few in number, and the flint implements are not typical.

The Azilian stage: This will be discussed in connection with the period intervening between the Palæolithic and the Neolithic Ages (see p. 55). It has close relationship with the Cave Period, of which it appears to be a final phase, in some respects degenerate, but it also links up with the early Mesolithic cultures.

Uses of the Implements of the Cave-men.

The small size of the flint implements of the cave-men, and the use they made of bone and ivory, support the evidence derived from other sources as to a change in the conditions of life after River-drift times.

From the Aurignacian stage onwards no Palæolithic stone implements are found which can be regarded as well adapted for hacking or chopping, either when held in the hand, or attached to a haft. The tools are such as might be used for cutting flesh or wood, for scraping skins or wooden shafts, for boring holes, for carving bone, or for similar light work. Some may have formed the points of javelins or spears, as is also certainly the case with many of the bone implements. The evidence for the use of the bow as early as Solutrian times is not convincing,

but it cannot be disregarded. If, as seems indisputable, the climate was for the greater part of the time cold and the land inhospitable, then it is probable that wood-working played only a small part in the arts and crafts of the cave-men. Unlike the modern Eskimo, they could obtain no driftwood from the wreckage of ships, and they must have made their spear and harpoon-shafts from the young stems or branches of trees. This would not necessarily call for large stone tools, though their absence is perhaps surprising. If they had canoes, these may have been made of skins, on a light wooden frame, as are the *kayaks* of the Eskimo.

In addition to their cave-dwellings, they may also have made skin tents, and their clothing was no doubt of the same material. It is probable that the cave-men were more or less migratory, the caves being perhaps used chiefly as winter habitations, whilst they wandered over the open country during the summer—indeed, relics of the cave-men have been found in the open in so many cases as to make it evident that they camped elsewhere, and even settled, at certain periods or seasons.

The Art of the Cave-men.

Case 17)

The French caves have afforded many remarkable examples of the artistic skill of the men of the Cave Period. During the Aurignacian and the Magdalenian periods, carvings and paintings, chiefly of animals but occasionally of man himself, were produced in great numbers.

Usually the animals selected were those which were no doubt used for food, the bison, the reindeer, the mammoth, and the horse, being favourite subjects for the artists. Other types, such as the wolf, the bear, and many others, including even fishes, are also represented. The art of sculpture, as well as that of engraving, was practised, and there are small bone and ivory figures of women, which are attributed to the Aurignacians. Carvings on bone and ivory, in both high and low relief, are numerous, and the finer examples of these, as well as the best of the small engravings, are of Magdalenian age. There has even been preserved an example of clay-modelling, in the form of two bison (about 60 c.m. long), found in the Tuc d'Audoubert cave (Ariège). Mention may be made of the modelled animals, etc., made in a kind of clay, and baked, which have been dug up in Moravia, on the sites of settlements of Aurignacian "mammoth-hunters"; but these were not cave-dwellers.

Groups of animals, and occasionally what have been interpreted as hunting-scenes, were engraved, but these are very rare, whilst representations of single animals are common. In some cases the carvings are on objects which are undoubtedly tools or weapons, and it is probable that this was usually the case.

Many of the representations are of high artistic merit, and their interest is increased from the fact that now-extinct forms such as the mammoth, were carved or engraved from the study of the living animal.

The paintings and engravings which are found on the walls and roofs of many caves of France and Spain are even more striking examples of Palæolithic art. They are of much larger size than the carvings in bone and ivory, and they afford proof of variations in technique and in artistic power during the Upper Palæolithic Period. Some of the figures were engraved, others coloured, and in many cases there was a combination of the two methods. The earlier examples were in outline, those of the early Aurignacian stage being in "absolute profile," but later the inner contours were often skilfully modelled. Some of the finest paintings ("polychromes"), of Magdalenian age, were done in red, yellow, and brown, as well as black.

The artists made use of natural colouring matters such as oxides of iron, and pencils and tubes of the paints have been discovered. Large groups of animals, as well as single individuals, were represented, and there are late paintings in some caves of Spain in which hunting and dancing scenes are depicted, and in which bows and arrows may be recognised. It is probable, however, that these scenes must be assigned to Mesolithic times.

As in the case of many backward peoples who show artistic powers, the cave-men were not successful in the representation of the human form.

It may be noted that the paintings and engravings in the caves were often done so far from the mouth that artificial light must have been necessary, and shallow stone cups have been found which may well have held the fat or oil of primitive lamps.

It has been surmised that the motives impelling the artists to represent animals familiar to them were not purely artistic, and that the representations have a magical or totemic significance. There can be little doubt that the artistic tendencies were fostered by the hunting habit of life, in which the faculties were absorbed in the study of the forms and behaviour of the animals which must be killed or captured to provide the tribe with food. The Eskimo of the Arctic and the Bushmen of South Africa have both manifested artistic powers comparable with those of the cave-men, and it may be significant that in all three cases we are dealing with hunting-people who pursued and stalked their prey over plains or snow fields. Under such circumstances no skill is too great to ensure an unobserved approach to within striking distance, and no powers of observation too keen to enable the hunter to predict the next move, if any, to be made by the hunted. In this way every detail of outline in all attitudes must be indelibly engraved on the mind of the hunter in open spaces,

and to transfer the permanent mental picture to bone or stone demands only ability and incentive. In the case of the cavemen, who possessed the ability, the incentive may have been magical in its aim. The fact that the wall-paintings and rock-carvings are found in the depths of caves, far from the range of daylight, strongly suggests that the display of artistic ability was not the main object in view.

(Case 18) ANIMALS OF THE PALÆOLITHIC AGE.

As already indicated, numerous teeth and bones of animals have been found in association with the implements of Palæolithic man, and further information as to the fauna of the later part of the period is afforded by the works of the cave artists. Some of the animals are now extinct, or are no longer to be found in Europe. In view of the great variations in climate during the Ice Age, it is not surprising that the animals identified should include forms which would now be regarded as tropical, temperate, and arctic, respectively. Early in the Palæolithic Age, perhaps in Chellian times, Western Europe had more than one species of elephant and rhinoceros (*E. meridionalis* and *antiquus*, and *R. leptorhinus* and *merckii*), a hippopotamus (*H. major*) and other warmth-loving animals, most of them now extinct. In cold periods, such as the Riss and the Würm, the extinct mammoth (*Elephas primigenius*), and woolly rhinoceros (*R. tichorhinus*), the reindeer (*Rangifer tarandus*), and other arctic forms appeared, whilst temperate forms, such as the horse, the bison, the red deer, the wolf, the brown bear, are especially conspicuous during the less severe intervals, and during the decline of the Würm glacial.

During a large part of the cave period, the mammoth and the reindeer were characteristic elements of the fauna, and they appear to have never been very far away from Western Europe. The horse (not yet domesticated) became common in a milder phase which followed the first climax of the Würm glaciation, but a return of colder conditions (during the Magdalenian) brought back the reindeer and other arctic forms.

Numbers of other animals, and many plants, of the Palæolithic Age have been identified. On the basis of evidence that the last glacial phase was fatal to many species of animals, it has recently been suggested that the earlier glacial phases were insignificant in comparison with the Würm.

THE MANNER OF LIFE OF PALÆOLITHIC MAN.

In discussing the manner of life of the men of Palæolithic times there are many considerations to be borne in mind, only the most important of which can be touched upon here. It has especially to be remembered that during the cold phases

the northern ice-sheets extended, with a fluctuating margin, over Scandinavia, Northern Germany, Holland, much of Russia, and most of the British Isles, and that the climate became milder, as it does to-day, in passing towards the south of Europe. The glaciers of the Alps, and to a less extent those of the Pyrenees, would have an influence over the temperature of the neighbouring areas, but these would not be uninhabitable, even during the height of a glacial phase. The regions between the mountain ranges and the northern ice-sheets may be supposed to have been at least as hospitable, and as well stocked with animal life, as are the areas occupied at the present day by the Eskimo and other peoples of the far north. The hunting-grounds of the cave-men must have comprised hills, valleys, and plains, as well as steppes and tundras, whilst he may well have extended his range much farther over the ice-sheets of the north than the evidence indicates. He was also, no doubt, less of a troglodyte than is suggested by the term " cave-man."

During an oncoming cold period the northern ice-sheets would extend southwards, and the alpine glaciers would encroach on their valleys; forests would disappear, or change their characters and their animal inmates. Plains would become steppes, hot in summer and very cold in winter, subject to storms of dust or snow. The dust storms gave rise to deep layers of fine deposits (löss), which have yielded important archæological finds. As the arctic area extended, the steppes would be converted into tundras, marshy plains frozen hard in winter, such as those of Northern Siberia at the present day. During these changes, there would be wide differences in the conditions in different areas, and tundras in the north would pass into steppes further south, the fauna varying also. South of the Alps and Pyrenees the climate, as now, would be warmer than further north, with the correlated differences in fauna.

The above are some of the factors that need to be taken into account in drawing conclusions as to the conditions under which the cave-men pursued their hunting life. In view of the complexity of these factors, it is not surprising that great difficulty is encountered in presenting a coherent account of the mode of life of our remote predecessors in Europe. But by combining the evidence that has been briefly set out in the foregoing pages, we are able to realise to some extent the environment of Palæolithic man, and the kind of life he led. It has been shown that the culture was not of the same character throughout the period, and that more than once race, or even species, of man, made and used the implements that have been described. It is clear, however, that none of the Palæolithic men had advanced beyond the primitive stage of culture which is characteristic of hunting peoples and food-gatherers.

River-drift man appears to have been in much the same condition as the recently-extinct Tasmanians, though he was in some respects further advanced in the art of stone-working. In structure he was, perhaps, more ape-like than Neandertal man, and this is certain if the Heidelberg jaw is regarded as Chellian in age. He may have lived in wandering families or tribes, keeping as a rule in the open, or near rivers and streams, and resorting to caves or rock-shelters for more or less temporary sojourn. We do not know whether he built any form of hut, and there is no evidence that he cultivated any food-plants. He was probably omnivorous, his food consisting of nuts, fruits, wild grain, roots, and such animals as he could kill with sticks and stones, with his other primitive weapons, or by means of simple traps. Some of his stone implements may have been used in hunting, but in the absence of hafts they could only be effective at close quarters, or as missiles. He doubtless made wooden clubs, and he probably had spears or javelins of wood, cut to a point, and perhaps hardened in the fire. He was probably familiar with fire, and with some method of obtaining it; in time of cold he used the skins of animals for clothing. He does not appear to have possessed any domesticated animals, not even the dog.

Mousterian man of Western Europe, of whose skeletal structure we know so much, was largely a cave-dweller. His implements do not indicate that his mentality was higher than that of his Acheulian predecessors. The fact that he made graves for the burial of his dead, and sometimes buried implements with them, suggests that he had a belief that the implements would be needed by the dead in another life. It is probable that he possessed the power of speech. In his general mode of life he probably differed little from Acheulian man, though it may well be that he lived a harder life, at any rate during the Würm glaciation and in Western Europe.

The men of the Upper Palæolithic, from the Aurignacian onwards, had advanced considerably beyond the stage of culture above outlined, as might, perhaps, be expected from the fact that they were men of the modern type, physically and probably mentally as well. They were hunters like their predecessors, but their weapons were more varied and effective, and they realised the value of bone and ivory for spear-heads and other implements. It is possible that the bow and arrow were in use before the end of the period. Their artistic powers were, as we have seen, of a high order of excellence as compared with those of Neolithic and most modern primitive races. There is no evidence that they had invented the arts of spinning and weaving, and they no doubt clothed themselves in skins. They do not appear to have cultivated the soil, or to have

had any domesticated animals. In many respects, the relics found suggest that the later cave-men, especially the Magdalenians, were in much the same stage of culture as the modern Eskimo, who are also hunters and fishermen, addicted to carving in and on bone and ivory. Some of the implements of the Magdalenians are very similar in style to those of the Eskimo, and the view has been urged—though it has not met with general acceptance—that the latter are descendants of the former, who are supposed to have migrated northwards as the glaciers and ice-sheets receded.

Early Types of Men of the Palæolithic Age.

It is not within the province of this Handbook to enter into a detailed discussion of the many problems arising out of the discoveries of the skulls and other bones of Palæolithic man. In the section of Physical Anthropology (North Hall) casts of the more important skulls are exhibited, and a Handbook on the subject of the origin of man has been issued ("The Ascent of Man").

Although remains of early man are rarely found, and when found are always imperfect, our knowledge of the skeletons, and especially the skulls, of the men of Palæolithic, and perhaps earlier, times has been greatly extended within the present century. The skeletal characters of one of the most interesting of the types, viz., Neandertal or Mousterian man, are now well known.

Neandertal man was until recently known mainly from a few portions of skulls, such as that of Neandertal itself, the first to be studied (found in 1856), and those of Spy. The Gibraltar skull was an earlier find (1848), but its significance was not recognised for some years. Much later discoveries (1908) are those at Le Moustier and La Chapelle-aux-Saints, both sites being in that region of France (Dordogne) which has provided such invaluable information relating to the men of the Cave Period. In these two cases—both were burials—the remains are not only less imperfect than the earlier finds, but they can be dated to the Mousterian stage of culture.

The race to which the skeletons belonged had a massive bony ridge over the eyes, a retreating forehead, a low flattened roof to the skull, and a non-protruding chin. In spite of these "low" and ape-like characters, Neandertal man had a brain as large as that of modern Europeans. Although unmistakably human, he has been regarded as sufficiently different from the modern type (*Homo sapiens*) to justify the institution of a separate species, *Homo neandertalensis* (sometimes called also *H. primigenius*, and *H. mousteriensis*). In addition to the characters mentioned above, the head was large and massive, as were the bones of his body.

He was short and thick-set, and he probably walked with the legs slightly bent at the knees and hips, with the heavy flattened head thrust forward. The body may have been covered with a coat of shaggy hair.

Of the remains of Neandertal man found in Italy and Gibraltar, no details need be given here, but attention may be called to the recent discovery (1932) of a number of skeletons of individuals of various ages in a cave on Mount Carmel, Palestine, since although they are associated with Mousterian (or Levalloisian) types of implements, and are apparently related to Neandertal man, they are sufficiently distinct to be relegated to another species. A warning has been given in previous sections that recent work makes it necessary to regard the "Mousterian culture," and even Mousterian man, as under some suspicion of being not quite what, for many years, they have seemed to be.

Hitherto no remains of Neandertal man have been found other than those which are either certainly or probably of not later date than the Mousterian. The bones of still more ape-like forms have been discovered in deposits of an earlier date. Mention may be made here, however, of the skull (and other bones) recently discovered in a cave in Rhodesia. The skull presents some features, such as an enormous brow-ridge, suggestive of relationship with Neandertal man, and the face itself is even more simian; the lower jaw is unfortunately missing. The appearance of the skull, and the situation in which it was found, do not prove a very great antiquity, and it may represent a type, perhaps even lower than the Neandertal, which managed to survive in the warmer climate of South Africa, long after Europe had seen the last of the early types of man. It has been given the name of *Homo rhodesiensis*.

With regard to the pre-Mousterian forms, brief reference must first be made to an Asiatic ape-man, or man-ape, who lived in Java in early Pleistocene times. It has been called *Pithecanthropus erectus*, and it probably represents an important link between man and the apes, though not an actual ancestor of modern man. The skull, only the vault of which was found, is more ape-like than any which has hitherto been claimed as human, but the brain was far larger than that of any known ape.

The importance of Java in relation to early human types has been enhanced by the discovery (1932) of incomplete skulls of a new type of man, in mid-Pleistocene deposits about twenty miles from Trinil, where the skull of Pithecanthropus was found. The new type has been named *Homo soloensis*, and it is more closely allied to Neandertal man than to Pithecanthropus, occupying in some respects an intermediate position.

Another recent discovery is that made in the cave of Choukou-tien, near Peking, China. Here there have been found

remains of a type closely allied to Pithecanthropus, though it has been given a generic as well as a specific name of its own—*Sinanthropus pekinensis*. In the same deposits, which are referred to the early Pleistocene, chipped stones (mainly quartz) have been found, and it is believed that these are tools made by Sinanthropus. There are also indications that he made use of bone, and was familiar with fire.

Of more interest in connection with the history of man in Europe are the Piltdown skull, found near Lewes in Sussex, and the Heidelberg, or Mauer, jaw (Germany), both from Pleistocene deposits. Piltdown man may have been the earlier of the two; the lower jaw, which was found near the fragments of the skull, is much like that of a chimpanzee, but the skull does not show the heavy brow-ridges and receding forehead met with in Neandertal man and the great apes. The brain—the form and contours of which may be deduced from the shape of the cavity which it occupied—must have been human in its characters, though it was in many respects primitive.

The Heidelberg jaw (lower), which is very massive and exhibits several other simian features, is universally accepted as human. The chin is very receding—more so than in Neandertal man—but the teeth are unmistakably those of a man. The jaw might have belonged to a form not unlike Pithecanthropus.

To the type represented by the Piltdown skull the name *Eoanthropus dawsoni* has been given, a new genus being thus founded. Heidelberg man, on the other hand, is by some placed in the same genus as ourselves, but in a new species (*Homo heidelbergensis*), whilst others regard it as the type of a new genus (*Palæanthropus*).

That modern man has been evolved from one of the above-named early forms is not regarded as probable, but though they may be on side lines that have ended blindly, they are of great importance in the study of the origin of man. Of late years there has been a tendency to refer back to a more and more distant period the time of separation of man and the modern great apes, from the common anthropoid stock in which both groups had their origin. It should also be noted that the factor of parallel development is being emphasised; it may be that some of the more conspicuous "ape-like" characters of early types of man were not directly inherited from simian ancestors, but were independently evolved. This question is too complex for discussion here, but it must be borne in mind that man may perhaps be more closely related to the gibbons than to the larger anthropoid apes such as the Gorilla and Chimpanzee.

THE MESOLITHIC AGE.

(Case 10)

This is the period of transition from Palæolithic to Neolithic times, and although it is no longer supposed that the gap between the Old and New Stone Ages is of the nature of a definite break in the continuity of the human occupation of Europe, the relics of the people of the intervening time are scattered and inconclusive ; nor do they afford evidence of the origin of the two most important innovations of Neolithic times—the cultivation of plants and the domestication of animals—and of other arts and crafts which appear for the first time in that period.

The Mesolithic cultures of Western Europe suggest that the territory was a sort of no man's land of wandering tribes of hunters and food-grubbers, in some cases Palæolithic survivors, and in no case foreshadowing the relatively high culture of the Neolithic herdsmen and cultivators. With the decline in the cave-dwelling habit, however, the conditions were less favourable for the preservation of relics from dwelling-sites, and it may be that the population was less scattered than appearances suggest.

The Mesolithic Age in Western Europe appears to have been a long one, and it may have lasted for three or four thousand years. It was partly coincident in time with the Neolithic and Predynastic cultures of Egypt, but beginning earlier and ending later, lasting perhaps from about 6,500 to 2,500 B.C.

The cultures that will be briefly referred to here are the Azilian, the Tardenoisian, the Maglemosian, the Ertebolle or Shell-mound culture, and the Campignian. That there was a relationship between the Azilian, the Tardenoisian, and the Upper Palæolithic cave-cultures, cannot be doubted, but the other cultures mentioned have some different aspects, and they afford evidence that influences from Neolithic areas were filtering through to Western Europe. The Capsian of North Africa, which extended also into Europe, is now regarded as Mesolithic ; it was related on the one hand to the Aurignacian, and on the other to the Tardenoisian. Certain rock-paintings in the east of Spain are believed to prove that the hunter's bow was known to the Capsians.

The Azilian Culture. The name is derived from the great cave or rock-tunnel called Le Mas d'Azil, in the South of France (Ariège). The flint-working has affinities with that of the Aurignacians and Magdalenians, but mammoth-ivory and reindeer-antler were no longer available, and deer-antler was used instead ; a characteristic implement is the harpoon-head of this material, flat in form, with two rows of barbs, and hole for a cord at the base. The art was reduced to geometrical figures and generalised representations. Small flat pebbles with red markings (chiefly

dots and bands) have been found, and have given rise to much speculation ; it is possible that the markings are modified human figure designs, and one of many guesses at truth suggests that they played a part in the cult of the dead. The Azilian culture has been identified in Spain, France, Bavaria, Scotland, Yorkshire, and some other regions.

Special interest attaches to the great interment at Ofnet (Bavaria), which is assigned to Azilian times. This burial contained a large number of skulls, some of narrow-headed, some of broad-headed type, and this is apparently the earliest conclusive evidence of the presence of broad-heads in Central or Western Europe, though some skulls of this class have been doubtfully assigned to the Solutrian phase. The Ofnet skulls represent the first invaders of Alpine type, and they appear to have got as far west as Furfooz (Belgium), Mughem (Portugal), and possibly the British Isles.

The Tardenoisian Culture. It has been shown that some, at any rate, of the very small chipped flints which are called "pygmy flints," or microliths, were made in Azilian times, and also that in the closing phase of the Aurignacian there was a tendency to reduce the size of the flint implements. The microliths are found widely distributed on the continent and in our own country, and they occur also in Africa from the Mediterranean to the Cape, in Syria and India, and elsewhere. They are now usually called Tardenoisian, after the name of a French site. They often occur near the shores of rivers or the sea, and in sand dunes or other sandy wastes.

Microliths were made from small flint flakes, which were often reduced to crescentic, triangular, and rhomboidal forms, one sharp edge being usually left untouched, and the thicker backs or sides finished by fine secondary chipping. Numerous theories as to their uses have been put forward, and they have been variously regarded as arrow-points or barbs (for which Egypt has supplied evidence), tattooing instruments, fish-gorges, borers, etc. In some cases microliths have been found lying in a linear series, indicating that the flints were sometimes fixed in a row along a wooden stem, forming a composite implement comparable with the knives and spear-heads of some modern Australian aborigines.

The term Azilio-Tardenoisian, frequently used, may represent local fusions or contacts, rather than a cultural unit.

The Maglemosian Culture is named after a peat-moss near Mullerup, Denmark, on the island of Zealand, other important sites being Svaerdborg and Holmgaard, also on Zealand. The peat-moss of Maglemose marks the site of an ancient lake, and it is probable that the settlements, or perhaps summer hunting camps, were situated on islands and low peninsulas. The objects

found are of stone, bone, and antler, and no potsherds have been discovered. The only domesticated animal was the dog, which was the first animal to be tamed and used by man. The bones of wild animals of the woods and waters afford evidence of the mode of life of the Maglemose hunters, who lived at a time when the Baltic was a closed lake, to which the name Ancylus Lake has been given.

The flint implements were simple in form, and included rare examples of the *tranchet* (see below), picks, scrapers, gravers, together with triangular flint points, and some other pygmy types. Bone and antler were more extensively used than stone, and were made into adzes, axes, hammers, chisels, knives, daggers, harpoon-heads, etc. Some of the antler axe-heads and adze-heads were perforated for a haft, and the adze was more in use than the axe. Adzes were sometimes made by fixing a flint blade in an antler-sleeve, perforated to receive the haft.

Similar cultures to that of Maglemose have been identified in Schleswig-Holstein, East Prussia, Finland and a few other regions. Two bone harpoon-heads from Yorkshire (Holderness), and others from the Thames, have been attributed to this phase, whilst another example has been dredged up from the bottom of the North Sea—at that time no doubt dry land.

The Maglemosian and the succeeding Ertebolle culture belonged to the climatic phases of transition, in northern and western Europe, from the Sub-Arctic conditions which followed the last glacial phase, to the establishment of a temperate climate essentially similar to that of the present day. The Maglemosians lived in a climate that was dry, and warm in its later stages; this is called the Boreal Period. It was followed by the Atlantic Period, warm and moist, and in the first part of this the shell-mounds of Denmark were accumulated.

Owing to the fact that the final retreat of the ice of the Glacial Period was followed not only by changes of climate, but also by the formation of forests, which flourished on the clays laid down by the glaciers and ice-sheets, the men who colonised the new lands had to adapt themselves and their material equipment to the special conditions of life, and the two cultures are therefore often called the Forest Cultures. We may now consider the second of them, that of the Shell-Mounds.

The Ertebolle Culture, named from a site in Jutland, Denmark, has such strong affinities with the Maglemose culture, that it can scarcely be doubted that the later developed, at any rate in large measure, from the earlier.

The characteristic shell-mounds are refuse heaps which contain shells of edible molluscs, (oyster, mussel, etc.), along with the bones of wild animals, such as the red deer and wild boar, and those of a domesticated dog; they also contain implements of flint and

bone, potsherds, remains of cooking-hearths, and other evidences of the mode of life of the Mesolithic men of this region. Flint picks and *tranchets* are found in numbers, together with flint scrapers, awls, and *petits tranchets*, or transverse arrow-heads. Bone and antler are no longer dominant, as they were at Maglemose, but awls, chisels, axe-heads, and adze-heads of antler were still made. In this period it was the axe that was more in favour than the adze. As in Maglemose times, pieces of antler were sometimes used as " sleeves " for stone blades or heads.

The *grand tranchet*, or " shell-mound axe " * is a flake-implement with a bevelled edge formed by the meeting of two facets, one the bulbar face of the flake from which the implement was shaped, and the other produced by a side-blow which removed a flake transversly across the edge. The implement is typical of the Mesolithic age, but at some later period it spread far beyond the limits of Europe, even into the South Seas (Solomon Islands).

All the Danish shell-mounds are on the coast, or what was forming the coastline, of the Littorina Sea, which represented the former Ancylus Lake, enlarged and connected up with the North Sea, like the modern Baltic. It may be noted that the terms *Littorina* and *Ancylus* are the generic names of two species of aquatic molluscs (shell-fish) that are found in abundance in the deposits laid down at the two periods of lesser and greater extension of the lake or sea. Sometimes the terms Ancylus Period and Littorina Period are employed.

The Campignian Culture was named from a hill in the Seine Inférieure, France, where ancient pit-dwellings were excavated, yielding evidence of a Mesolithic culture at the lower levels, and of Neolithic arts and crafts at the higher. The presence of flint picks and of *grands* and *petits tranchets* has led to the association of the Campignian culture with that of the shell-mounds, and to the grouping of the two as aspects of the Ertebolle culture. Under its old name, the Campignian culture has been recorded in France, Belgium, Germany, Italy and elsewhere, whilst the " Thames picks " and the rare *tranchets* of south-eastern Britain have been assigned to this phase of the Mesolithic.

Of late years much attention has been given to the Mesolithic industries of this country, as well as of the continent, though they are less fully represented here. In Britain it is the Tardenoisian that is most widely spread, and in the south-east of England it is often associated with " Campignian " elements, such as the axe or pick with its cutting-edge finished by a tranchet blow (" Thames pick "). The microliths of the north, west, and north-west, are often geometrical in form, and these represent a higher and a later grade of the microlithic industry than do those of the

* This is a term often employed, but the implement is better adapted for use as an adze rather than an axe.

south-east, which are less regular and less standardised in their forms. Productive sites for microliths have been found in Kent, Sussex, Lincolnshire, Devon, Cornwall, Wales, the Mendips, the Pennines, the Isle of Man, and elsewhere.

A characteristic form of microlith is the micro-burin, though there are differences of opinion as to whether this was made as an implement, or was merely a by-product in the making of other pygmy flints.

As already mentioned, the Azilian and the Maglemosian cultures are represented in Britain by a small number of identified sites or isolated discoveries.

In the Baltic region there are other Mesolithic cultures which have received names of their own (Lyngby, Nostvet, Limhamn), but these cannot be discussed here. The "tanged-point" cultures of Northern Europe are also omitted. The Asturian is a local culture (coast of north Spain and of Portugal), of late Mesolithic times, and it has been suggested that it is represented in Ireland.

Pollen-Analysis.

Brief reference may be made here to the application of pollen-analysis to the investigation of climatic and other changes during the Palæolithic, Mesolithic, and later periods. By counting the numbers of pollen-grains of various trees (such as pine, hazel, oak, alder, etc.) in small samples, taken at different levels from a deposit (usually of peat), conclusions may be drawn as to the predominant trees of the period during which the deposit was formed. Thus the dry post-glacial Boreal phase mentioned above was, to begin with, characterised by forests of birch and pine, which gradually gave place to a mixed oak forest (oak, elm, lime, hazel, alder, etc.), and this persisted during the warm and moist Atlantic phase, in which there was also much peat-formation. The succeeding Sub-Boreal phase, and the still later Sub-Atlantic phase, were characterised by beech forests.

The method of pollen-analysis is now being applied to investigations in more than one region of the British Isles, and the results obtained are proving of value not only in relation to Stone Age finds, but down to as late as the Early Iron Age.

Cases 20—32) THE NEOLITHIC AGE.

The general conditions prevailing in Western Europe during the Neolithic Age were similar to those of the present day. The climate had become temperate (late Atlantic phase), and Great Britain lost its land connection with the continent about the beginning of the period.

The full Neolithic culture was far more advanced than that of the hunters and food-gatherers of the preceding periods. Various food-plants, including the all-important cereals, were cultivated for food, and the domestication of useful animals, including especially the dog, pig, goat, sheep, and ox, is further evidence of a higher status. Spinning, weaving, and pottery-making (without the wheel) were amongst the useful arts that were practised, and dwellings of more than one kind were constructed. The stone implements were in most cases hafted for use, and methods of grinding, polishing, and perforating stone were generally known. The late Neolithic sepulchral mounds and stone monuments (megaliths) afford evidence of a relatively high social organisation, and of a well-developed religious cult.

In Britain, the traces of occupation by Neolithic man are found most abundantly on the uplands, such as the Chalk Downs, the Cotswolds, the Derbyshire moors, the Yorkshire wolds, and the sandy heights of Norfolk and Suffolk. Here, as on the continent, forest areas were avoided ; this had an important influence on the development of culture, since it gave rise to areas of isolation, from which arose some independent variation in arts and crafts.

There is no doubt that copper was in use, but to an extent that varied greatly in different regions, during a large part of the Neolithic Age.

It is held by some that there were areas in which polished stone celts were rare until the Bronze Age, and it is agreed that all, or most, of the tanged and barbed flint arrow-heads date from this period. Owing to the difficulties arising from the complexities of the evidence, both the beginning and the end of the Neolithic Age can be only vaguely defined. Moreover, it has been found impossible to arrive at final conclusions as to the stages in the diffusion of culture during the period. The evidence in the British Isles is in some respects particularly inadequate, and it suggests that here the Neolithic culture was by no means advanced, agriculture, for example, being little known, and other arts showing slight evidences of activity. The Neolithic Age in Scandinavia admits of more satisfactory treatment, whilst the Swiss Lake Dwellings afford invaluable evidence, especially in relation to the food-plants grown or utilised in this region, and to the types of stone implements and their hafting. The cultures

II.—Stone Implements (Axe-Heads and Adze-Heads) of Neolithic Type.

(See p. 62.)

1. Ireland.
2. Bundelkund, India.
3. West Indies.
4. British New Guinea.
5. Denmark.
6. New Zealand.
7. Ireland.
8. Sierra Nevada, South America.
9. New Zealand.

of the Danube Valley are of even greater importance, especially for the understanding of the diffusion of knowledge from east to west.

In view of the numerous contrasts between the Palæolithic and the Neolithic cultures, the question as to the place of origin of the latter has been much debated. The Mesolithic Age supplies very little evidence. Both Eastern Europe and North Africa no doubt contributed to the peopling as well as to the material culture of the west, but the data cannot yet be pieced together to give a connected account of the origin of the men and the cultures of Western Europe in Neolithic times. That there were Mesolithic, and perhaps Palæolithic, survivals is generally agreed, and some of these may well have adopted introduced arts and crafts, whilst in other cases immigrants already in the Neolithic stage of culture were probably in sufficient numbers to dominate their predecessors. A slow diffusion of cultural elements, as well as movements of peoples, must have played a part in the transformation.

Subject to the usual warning as to the provisional nature of estimates expressed in terms of years, and also as to the differences of opinion amongst archæologists, the beginnings of the Neolithic Age in Western Europe may be placed at about 2,500 B.C., with a rather later date for Britain. In contrast with this, there was an agricultural settlement at Susa, on the borders of Mesopotamia, at a period estimated at about 5,000 B.C., whilst Badari and the Fayum in Egypt give further evidence of the cultivation of cereals at about this time. It may be noted, also, that copper was known both at Susa and Badari, and that pottery was made. The domestication of animals, with the exception of the dog, may have been a little later than the beginnings of corn-growing. Of late years evidence has accumulated concerning the early advanced cultures of other regions, and it is becoming more and more evident that the characteristic features of the Neolithic culture of Western Europe were introductions from the East, partly across Europe (e.g., by way of the Danube Valley), and partly by sea from the Mediterranean lands. The spread of a relatively complex culture over a wide area would necessarily be slow; the diversified character of the country would lead to great inequalities in the rate of progress in different parts, whilst some cultural traits would not travel at the same rate as others. Where the spread of culture was effected by invasion and conquest, the process would be accelerated.

It is only recently that light has been thrown on some aspects of the Neolithic Age in Britain, concerning which little was established except the more obvious facts concerning the stone implements, the long barrows, and the megaliths. There is now no doubt that more than one intrusion of people from the continent

brought about the replacement of Mesolithic by Neolithic culture ; two of these may be identified by types of pottery, the third being the Megalithic culture.

Windmill Hill, in Wiltshire, has provided pottery, implements of flint, bone, and antler, saddle-querns, and remains of domesticated animals. The earlier pottery of the site consists of round-bottomed bowls of fairly hard ware, sometimes with lugs and loop handles. Ornament on this ware is not common, but occurs as scorings, finger-tip and finger-nail impressions, and " pin-prick " patterns. This " Windmill Hill pottery " appeared first in the south of England, but later it spread over the whole length of Britain, from Sussex to the Orkneys, mainly on the western side. The presence of push-querns (saddle-querns) is presumptive evidence that corn was grown. It is probable that these early Neolithic people came across the channel from north-east France.

" Peterborough pottery " represents another intrusion of peoples, probably across the North Sea, since the ware has Baltic affinities. This also consists of round-bottomed vessels, of coarse fabric and freely decorated with cord-impressions, comb-markings (such as the " maggot " pattern), and deep pittings. It is found chiefly to the east of Britain, with westward extensions, and it is common in Wessex. It occurs in the upper layers of the deposits at Windmill Hill.

The Long-Barrow or Megalithic culture represents a spread from the Mediterranean by the Atlantic route, and in the first instance it impinged upon the western shores of these islands.

Before the beginning of the Bronze Age, there had taken place an intimate contact, and in some degree a fusion, of the three Neolithic cultures, as is especially manifested in Wiltshire.

Neolithic Implements.

Neolithic implements have been found all over England, Scotland, and Ireland. On the Continent they may also be said to be generally distributed, but those from Central Europe and the Danube Valley, France, Denmark, and Switzerland (Lake Dwellings) are especially numerous and important. They are usually found on or near the surface of the ground, in bogs, at the bottom of lakes and rivers, and in graves or burial mounds.

As in Palæolithic times, some types of implements were usually made from blocks or pebbles of flint or other stone, whilst others were made from flakes, usually flint. To the first belong axe-heads and adze-heads, chisels, gouges, and hammer-heads. These were frequently finished by grinding and polishing. Amongst those made from flakes are scrapers, borers or awls, knives, spear-heads, arrow-heads, and serrated flints for sickles, which

were rarely or never ground or polished. The stone tools used in the manufacture of implements include hammer-stones, fabricators (?), and grindstones. Other Neolithic stone implements are sling-stones, spindle-whorls, and millstones (the push-quern), all of which continued in use till later times.

It is frequently impossible to say whether a "Neolithic" stone implement does not belong to a more recent period, since many of them continued to be made and used after the knowledge of metal became general, some dating even from the Early Iron Age. In addition to implements of stone, there have been found wooden clubs; bone needles, awls, chisels, and spear-heads; and hammers, picks, axes, and hoes, of deer-antler.

From the few specimens that have been found with the stone implement still fixed in a haft, it appears that the stone axe-head was often mounted by being inserted in a hole in its wooden haft, that knives were made by fixing the stone blade lengthways in a wooden grip, and that smaller implements, such as arrow-heads, were attached by means of gum and lashing. The use of antler-sleeves for hafting axe-heads was prevalent especially in the Lake Dwellings of Switzerland. The perforated axe-heads of late Neolithic (and Bronze Age) times were, of course, hafted by fixing the shaft in the perforation; many, perhaps most, of these were battle axes, and clubs or maces were similarly constructed.

It is not possible to enter into a discussion of the different types of celts, arrow-heads, etc., that characterise the early and late stages of the Neolithic Age, nor of those that are typical of the Bronze Age. From the strictly archæological standpoint the flint arrow-heads of the Bronze Age should be separated from those of the Neolithic Age, but from the technological standpoint such a separation is undesirable. All the exhibited specimens of flint arrow-heads will therefore be found grouped under their respective countries of origin.

The Museum collection of Neolithic implements from Great Britain is not large, but it contains examples of the chief forms. Ireland and Denmark are well represented, and there is a fairly good series from the Swiss Lake Dwellings.

Case 23) THE FLINT MINES AT GRIME'S GRAVES.

The well-known Grime's Graves, as seen at the present day, are shallow depressions in the ground, near Weeting, Norfolk, and they indicate the positions of a large number of pits in the Chalk, from which flint for making into implements was obtained by Stone Age man. Excavations have shown that the pits were about 30 feet in diameter at the top, or even more, but were narrower at the bottom. The depth, usually also about 30 feet, was such as to enable the miners to work the best seam

of flint, not only in the shaft, but also in the galleries driven outwards from the bottom. These galleries often connected one pit with another. Not all the pits have galleries, some, which are probably the earlier in date, being simple shafts dug into the chalk.

The principal mining implements were picks of red-deer antler, punches and chisels of the same material being also used ; in the simple pits, however, use was made of the long bones of large animals as hand-picks.

Cup-shaped blocks of chalk, probably for use as oil-lamps, have been found in the pits. The numerous flint implements and waste flakes that occur in the neighbourhood, as well as in the fillings of the pits, indicate that flint was worked as well as mined in the district, as would be expected.

The Grime's Grave pits are usually regarded as of Neolithic Age, as are also the similar pits at Cissbury, Sussex, but an earlier beginning has been suggested. The animal remains do not contradict the prevailing view, but the implements are not consistently of Neolithic types. There is evidence, however, that polished stone celts were sometimes used in excavating, and this would indicate a late Neolithic date. Some flints have been found that bear representations of animals, in a style reminiscent of that of the Cave Period. Recent excavation suggests that there is an intermingling of more than one period of the Stone Age, and that whilst most of the pits are Neolithic, others were perhaps dug in Mesolithic times. One working site within the area has provided tortoise-cores and Levallois flakes, and it has been suggested that the simpler pits are even Palæolithic in origin. The problem cannot be regarded as finally settled, though it can scarcely be doubted that most of them are of Neolithic age.

The specimens exhibited include implements from Cissbury, as well as from Grime's Graves.

A Stone-Working Site at Graig-lwyd, on Penmaen-Mawr, North Wales.
Case 24)

The specimens from this site illustrate stages in the manufacture of implements, chiefly axe-heads and adze-heads, from a kind of felsitic rock found on the mountain. The original working-floor now lies just under the turf, and over a considerable area of the mountain-side abundant remains of the industry have been found. Together with the axe-head and adze-head, chisels and a few scrapers occur, and the number of waste flakes is very large. The hammer-stones with which the flaking was done are mainly beach pebbles, from one to six pounds in weight. The scarcity of polished implements indicates that this process was carried on elsewhere ; finished celts of Graig-lwyd stone have been found in several parts of Britain.

Most of the implements discovered were broken or were "wasters," since only the results of unsuccessful flaking were thrown away. As may be seen from the examples shown, the discarding of an unfinished implement was often due to the fact that the material was refractory or defective, and the proper thinness for the desired implement could not be attained. In other cases, the implement, sometimes when near completion, was broken across by an ill-directed blow, or in an effort to remove a stubborn "hump." A noteworthy feature is the very large size of many of the blocks of stone that were chosen for shaping, and of the flakes produced from them.

The industry cannot be dated with precision, but it is probably late Neolithic, perhaps belonging to a time when bronze was already in use in some parts of Britain.

Cases 28—29) THE NEOLITHIC AGE IN SCANDINAVIA.

Denmark, and the Scandinavian peninsula, were apparently not occupied by man until Mesolithic times, after the glacial ice-sheets had receded northwards. The earliest implements found in the region are those of Maglemose, Lyngby, and the Shell-mounds. (See p. 56).

The art of flint-working was, during the later part of the Neolithic Age, carried to a higher level in Denmark than in any other part of Europe, and many fine examples are exhibited. The axe-heads (of flint and other kinds of stone) are remarkable for their size, symmetry, and the perfection of their flaking or polishing; the various types are of service in the sequence-dating of the phases of the Neolithic Age in this region. Long flint chisels were made, and heavy gouges, whilst the knives, daggers, and large spear-heads are often noteworthy for excellence of workmanship. The late flint daggers with an ornamental zig-zag line on each face of the handle, which is in one piece with the blade, are especially interesting; the zig-zags were done in imitation of the stitching of the leather grip which was sewn on the handle of the bronze daggers, whose form was imitated in flint.

Towards the end of the Neolithic Age, the stone heads of axes and clubs were often perforated for the reception of the haft, though many such specimens (as well as some of the unperforated heads) belong to the Bronze Age or later.

The Megalithic culture (see p. 68) was an introduction from Western Europe, with an ultimate Mediterranean source of the idea of burial in stone chambers. Many of the finer flint implements belong to this time, and there were new forms of pottery. This culture was only a little earlier than the appearance of another which was characterised by burial in separate earth-graves, and by special forms of battle-axe; it appears to have been

introduced by pastoral invaders from Central Europe, and relationships with South Russia, and eventually with Mesopotamia, are indicated. The Scandinavian Neolithic Age began late, and ended late.

The Swiss Lake Dwellings of the Neolithic Age.
Cases 30—31)

In some parts of Europe, especially in Switzerland, Neolithic man built villages consisting of huts supported on platforms raised on wooden piles, driven into the bed of lakes near the shores. The remains of many such villages have been found in the Swiss Lakes, and they may be compared with the pile-dwellings of existing natives of New Guinea and elsewhere, which are found in estuaries and even in the sea.

The Swiss Lake Dwellings, or Pile-dwellings, were occupied during the Neolithic and the Bronze Ages, and some even into the Early Iron Age. From the objects found at the bottom of the lakes, in association with the remains of the huts, platforms, and piles, we know that Neolithic man in this region possessed a few domesticated animals, such as dogs, oxen, sheep, goats, and pigs, though some of these were very scarce. He cultivated wheat, barley, and millet, and ground his grain between two stones, but the rotary handmill, or true quern, was not yet known. Skins were no doubt still used for clothing, but flax was grown, and its fibres spun, and woven or netted ; it seems probable that wool was also spun and woven. The art of the potter had made considerable progress, but in the Neolithic villages the potter's wheel was not known. Many of the more perishable remains owe their preservation to the fact that huts or villages were often burnt down, by accident or otherwise, the carbonised residues surviving in the mud of the lake bottom.

The implements were similar to those of Neolithic man in the rest of Europe, but more extensive use was made of bone and antler for awls, chisels, harpoon-heads, etc. The stone axe-heads were often fitted into sockets of antler, and these were then forced into perforations in the wooden hafts. Examples of these antler-sleeves are exhibited.

Although the men of the Lake Dwellings were herdsmen and cultivators, they evidently relied largely for their food on the products of the chase, and they made use of many wild fruits.

In its more remote origins the Neolithic culture of the Swiss Lakes must be associated with Mesolithic peoples making use of bone and antler as well as stone, and later with the spread of more advanced cultures up the Danube Valley into Central Europe. Still later Neolithic developments in the Lake Dwellings owed much to contacts with peoples coming from the west and north.

The Dwellings and Camps of Neolithic Man.

The greater number of the dwellings of Neolithic man have disappeared without leaving any traces, but we cannot doubt that he had huts, and possibly skin tents, comparable with those of modern Stone Age peoples. He also made occasional use of caves and rock-shelters. The best preserved remains of his habitations are those of *pit-dwellings* and *pile-dwellings*.

In recent years much information has been derived from the excavation of camp-sites, these being areas in which were villages protected by ditches, and sometimes also by slight ramparts. Windmill Hill, already referred to, Whitehawk Camp, near Brighton, and Hembury (Devon), are specially important.

The pit-dwellings now appear as shallow depressions in the ground, often called hut-circles, such as have been found, for example, on Hayes Common, Kent. These were originally excavations some four to five feet deep, and six to as many as thirty feet in diameter. The walls of the pits were sometimes lined with stones, and it appears that in some instances a pole was fixed upright in the centre of the floor to serve as a support to the roof. The latter was probably formed of a number of poles or branches projecting inwards from the edge of the pit, and on these turf or other material was laid, or clay was plastered. It is known that in some regions huts above ground, rectangular in plan, and of better construction than these pit-dwellings, were erected by Neolithic man, especially in Eastern and Central Europe.

The pile-dwellings, best known from those of the Swiss Lakes, were rectangular huts built on platforms raised on piles from 15 to 30 feet long, driven into the beds of lakes or rivers near their margins. The huts themselves were of poles interlaced with flexible shoots or branches, and plastered with mud ("wattle and daub"), and in size were some twenty by thirty feet. Remains of pile-dwellings have been found in a few localities in Britain, but these are post-Neolithic; the same is true of the *crannog*, another form of lake-dwelling. The *terremare* of North Italy were settlements of pile-dwellings on dry land, surrounded by a rampart and a moat; they belong to the Bronze Age, but they are developments of the lake-dwellings.

Attention may be called here to the valuable services rendered to archæology, since the war, by the utilization of air-photography. By photographing various kinds of archæological sites from aeroplanes, markings are visible in the photographs which are inconspicuous and easily overlooked by the investigator on the ground. The "bird's eye view" of a large excavation site is also of great value. In some cases, an air-photograph has called attention to archæological possibilities which excavation has confirmed.

Case 32) LONG BARROWS AND MEGALITHS IN BRITAIN.

Long Barrows. In the Neolithic Age, and down to Roman times, it was the custom to bury the dead, often several or many in one burial-place, beneath large mounds of earth or rubble. Owing to the fact that the Neolithic mounds or "barrows," of Britain, are much longer than they are broad, they are called *long barrows*, to distinguish them from the *round barrows* of the Bronze Age. In dimensions and proportions the long barrows vary considerably, but they are usually from 100 to 120 feet in length, 50 to 80 feet in greatest breadth and 6 to 12 feet in height; greater dimensions, up to 330 feet long, over 100 feet broad, and 20 feet high, have been recorded, though not in the same barrow.

The cremation of the dead was a rare practice in Neolithic Britain, but it appears that it was customary for bodies to be exposed to decay for a time, and that the separated (and even broken) bones were afterwards given burial. In this way it was possible for a number of burials to take place at one time, but it is not suggested that this was the reason for the delay in the disposal of the remains.

Some long barrows—"chambered barrows"—are found to contain one or more burial chambers (see below, Megaliths), built of large rough stones, or slabs of rock, lying under the highest part of the barrow, and often accessible by means of a passage consisting of stone walls and roofing-slabs—hence the term *passage-grave*. This passage emerged near the surface at one end of the base of the mound, and it afforded a means by which additions could be made to the number of occupants of the family or tribal tomb. At various later periods, also, the passage was used to gain access to the burial chambers, often, no doubt, in search of treasure, and this may in part account for the paucity of archæological evidence afforded by the long barrows. In Iberia, Brittany, and Denmark, on the other hand, much evidence has been obtained from burial chambers, and the same is true of some other regions.

Not all barrows contain chambers of stone, and it is probable that where suitable stone was scarce, wood was used instead. In other cases special burial chambers were wanting.

The few objects found in the long barrows of Britain include fragments of crude pottery, and leaf-shaped flint arrow-heads. It is generally believed that the barrows should be assigned to the end of the Neolithic Age, but there is uncertainty as to their relationship with the megaliths, in point of time; and it has even been suggested that the barrows are early rather than late Neolithic. Their relationships with the megalithic culture of the continent is also uncertain. In Britain they are found in greatest

numbers in some of the central southern counties (e.g. in Wiltshire, Dorset, Gloucestershire, Somerset, Sussex), but they occur also in other parts (e.g. Lincolnshire, Yorkshire).

The human skulls that have been found in the British long barrows suggest that the population of Britain was uniformly long-headed (*dolichocephalic*), whereas in the succeeding Bronze Age there was an intrusion of broad-heads (the *brachycephalic* Beaker-folk and others).

Megaliths. The stones used in the erection of megaliths are of many sizes and shapes. Some are small enough to be freely handled by one person, and were used for dry-walling, whilst others, weighing several or many tons, are in reality masses of rock rather than stones. Although it cannot be asserted that the stones of megaliths were never worked or dressed, their general forms and appearance justify the old term "rude stone monuments."

Dolmens.—These are perhaps the best-known megaliths in this country. The term is applied to a group of two, three, or sometimes more, upright stone pillars or slabs upon which rests a large capstone. At the present day the dolmen usually stands freely in the open, the greater part of the upright stones being above the surface of the ground. It is generally believed, however, that this exposure of the dolmen is due to the removal of a covering mound, and that the structure is in reality the burial chamber of a chambered barrow. There is often an indication of the former existence of the barrow, and the general structural correspondence between the dolmen, and a terminal chamber of a passage-grave (or passage-dolmen), supports the prevailing view as to their relationship, though not all dolmens had passages. The general distribution of dolmens in the British Isles does not coincide with that of long barrows, and it is more conspicuously western and coastal.

A few models of dolmens are exhibited.

The *Kist* or *Kist-vaen*, of the end of the Neolithic Age, or more usually of the Bronze Age, is a box-like stone tomb or coffin, much smaller than the dolmen, and unlike it in form, but it is sometimes large enough to contain more than one burial.

Stone circles are of various kinds, some of them representing a ring of stones that was originally set up round the base of a burial-mound. Most stone circles date from the Bronze Age, and they are especially characteristic of Britain.

Great circles, such as Stonehenge and Avebury, may have been derived from sepulchral monuments. The former appears to have been originally of this character, and it probably had a simple beginning very late in the Neolithic Age, whilst most of the existing structure dates from the Bronze Age.

Mention must be made here of the recently discovered Woodhenge, situated near to Stonehenge ; it evidently consisted of rings (six in number) of wooden posts, the outermost ring being 144 feet in its longest diameter. The "Norwich Woodhenge," at Arminghall, was a comparable, but simpler erection.

A model of a stone circle from Aberdeenshire is exhibited ; this had a stone kist buried at the centre. A model of Stonehenge is also shown.

Alignments are single or double rows or avenues of upright stones, often associated with stone circles, as was the case at Avebury.

Menhirs, or standing stones, occur either alone or in association with other stone monuments. In some cases they are of immense size, one at Dol in Brittany standing 28 feet above the soil and 16 feet below, and in the same country there formerly existed a menhir 64 feet high. The menhir may be said to have persisted in the form of obelisks, monuments, and tombstones.

The moving and erecting of the huge stone blocks for these megalithic structures indicate a relatively high condition of culture, in which the co-operation of large numbers of men was available for purposes not utilitarian. The work may have been carried out under the direction of a kind of priesthood, such as the Druids of later times.

Megalithic remains such as the above occur in various parts of Great Britain and Ireland, and in the North-West, West, and South of Europe. They are particularly numerous in Portugal and the south of Spain, in Brittany, and in Denmark. Comparable structures are found in North Africa and Southern Asia, in Japan, and even in the islands of the Pacific. Their absence from Central Europe has important bearings on the question of the origin of the peoples and culture of Europe, as it indicates areas which were never under the influence of those who raised such monuments. The general question of the significance of the distribution of megaliths, in relation to the spread of races and the elements of their culture, is too vast to be considered here. It is obvious, however, that there could be no diffusion of the megaliths themselves, but only of the underlying ideas and motives, together with knowledge of forms, and of methods of construction. The considerable variety in the character of the megaliths in different regions is therefore easily understood. The general distribution of megaliths indicates that it must be explained as a result of maritime migrations and communications. As already mentioned, the original source of the megalith-idea was in the Mediterranean region (perhaps North Africa) with the Iberian Peninsula as a secondary area from which there was diffusion to France, the British Isles, and Scandinavia.

The Transition from Stone to Metal.

(Case 33)

Consideration of the relationship between the Neolithic and the succeeding Bronze Age once again raises problems of origins, and of migrations and contacts of peoples. The transition from stone to copper or bronze was not accompanied by any fundamental changes in other directions, and it was effected gradually. As usual, the evidence indicates that there were continual movements of peoples in Europe, and that the British Isles received immigrants from various parts of the opposite shores of the continent, with the result that differences in the intruding cultures are observable when the east, south, and west of Britain are considered.

There can be no direct evidence as to the manner in which copper and bronze were first discovered and made use of by man, but the Indians of some parts of North America, though they were mainly in their age of stone, afford examples of what appear to be early steps in the use of metal, such as may have been passed through in the Old World. It may be, however, that metal-working was introduced into America, and that the simple methods of some Indians are due to retrogression.

Over a wide area of North America, especially near the Great Lakes, native copper was hammered into ornaments and implements, without any attempt at melting and casting, though heat appears to have been sometimes used to soften the metal. Meteoric iron was used to a smaller extent in the same way.

In Ancient Peru, copper ores were smelted, the metal was alloyed with tin to produce a bronze of varying composition, and implements were cast. In Ancient Mexico, also, copper appears to have been obtained from its ores.

In the Old World, the evidence suggests a similar sequence of discoveries and applications :—the hammering of native copper ; the melting and casting of native copper ; the reduction (smelting) of copper ores ; the alloying of copper with tin to produce bronze. It is possible to make various speculations as to the part played by accident in revealing the properties and potentialities of the metals and their ores, but it must suffice to emphasise again the importance of the fact that the copper occurred in nature in the metallic state—"native copper"—which needed only to be hammered and cut into shape. Gold also occurs "native," and even iron is in the metallic state in meteorites. The attractiveness of these three metals to stone-age peoples is evidenced by the fact that they were at first used for small ornaments, and thus experience of their properties was gained. In the case of gold, of course, it was found that its softness rendered it useless for implements, but copper (and bronze) and iron had the more practical applications with which we are familiar.

THE AGE OF COPPER AND BRONZE IN WESTERN EUROPE

Cases 33—36)

The stone implements of Neolithic man were gradually superseded as a result of the discovery of metals. In some regions the transition was apparently from stone to copper, and there was a period of varying duration in which stone and the metal were in use side by side (*Chalcolithic* or *Aeneolithic* phase). In other regions it would appear that the use of metal did not become general until bronze had been produced, and introduced.

As already noted, Northern and Western Europe were late in receiving a knowledge of metal-working. Bronze was known in Mesopotamia before 3000 B.C., though perhaps as an accidental product, due to the use of a mixture of ores of copper and tin. It was not until after 2000 B.C. that Britain entered on its Age of Bronze, and it may be that the alloy was not made intentionally anywhere before about 2300 B.C.

Mesopotamia, Cyprus, Egypt, have all been suggested as the original sources of the first implements of metal. Cyprus was especially noted for the abundance of its copper ores, and the Roman name for copper (*aes cyprium*) has given origin to the name for the metal in most European languages.

Although copper was in many respects a great improvement on stone, it was too soft for many purposes. By the addition of tin this defect was partially remedied, and the bronze so produced was much better adapted for making efficient tools and weapons.

Bronze is an alloy of copper and tin, the best mixture for implements being about ten parts of copper to one of tin. After the alloy and its merits were discovered, the replacement of stone by metal became more rapid, and knowledge of the new material and its manufacture became widely spread over Europe. Some stone implements, such as arrow-heads, and some stone axe-heads, persisted in use throughout the Bronze Age, and even later. The characteristic Neolithic arts and industries were continued and developed.

The Bronze Age in Western Europe began about 2000-1800 B.C., and lasted for some thousand years, when a knowledge of iron began to penetrate the west. In some parts of Europe the Bronze Age both began late and ended late. In Britain iron was displacing bronze from about 600 B.C., but the change had not been completely effected when the Romans came. In the civilisations of the Eastern Mediterranean, on the other hand, the Bronze Age was coming to an end as early as 1200 B.C., the working of iron for implements having begun in Western Asia in the 14th century B.C. if not earlier (see p. 78). As a rough approximation, it may be taken that round the head of the Mediterranean, copper was known before 4500 B.C., and bronze

before 2000 B.C.; the general use of these materials was, however, later than these dates. From this cradle of civilisation, and by more than one route of diffusion, Western and North-Western Europe received from time to time the knowledge and incentives that carried them from dependence on stone to the practice of metallurgy. Two main lines of communication were open, one by the sea-route of the Mediterranean and Atlantic, the other overland across Central Europe ; the desire for the amber of the Baltic, which was highly valued by the civilised peoples of the South-East, played a great part in the establishment of trade-routes across the Continent, whilst gold, tin, and copper were attractions to the west by the sea-route.

The skulls of a broad-headed (brachycephalic) people, as well as those of long-heads and intermediate forms, are found in the round barrows of Britain, and there are other evidences of invasions and immigration at this period. The broad-headed "Beaker-people," probably a Nordic-Alpine cross (see p. 82), played an important part in modifying the culture, and to a slight extent the physical type, of the people of these islands.

The Beaker-people (named from a form of earthenware vessel that was deposited with their dead) appear to have come over from the neighbourhood of the mouths of the Rhine soon after 2000 B.C., the earlier arrivals, but not the later, being perhaps without a knowledge of metal-working ; the bronze implements of these people were in any case of simple types (plain celts, knife-daggers, etc.). They landed on the east coast, and gradually spread over a large part of Britain. They were the first to build round barrows over their dead. Recent investigations suggest that another invasion of beaker-makers brought a similar culture to south-eastern England. The centuries from about 2000 to 1500 B.C., may be said to cover the Early Bronze Age, whilst in the Middle Bronze Age, say 1500 to 1000 B.C., the process of fusion between the Neolithic people and the beaker-folk was in progress. During the Middle Bronze Age, palstaves, long daggers, rapiers, and spear-heads with side loops, were in use. About 1000 B.C. another wave of invasion, probably of people of similar physical types (Nordics, Alpines, and mixed), entered Britain from the east, bringing bronze swords (leaf-shaped), socketed celts, sickles, and new pottery types, and these invaders finally dominated practically the whole of Britain. Their culture had been developed, in large measure, in Central Europe.

Implements of the Bronze Age.

Objects of bronze have been found all over Europe, as isolated discoveries, as funeral gifts in graves and tombs, and in hoards. A hoard is the term given to a collection of bronze objects, with or without unworked bronze, which may have been temple

treasure, or a store of private property. Some hoards appear to represent the stock-in-trade of dealers, or the raw material of the itinerant metal-worker.

Hoards are especially characteristic of the late Bronze Age.

Axe-heads, chisels, daggers, knives, sickles, spear-heads, and swords are typical implements of the Bronze Age. Mace-heads, trumpets, and circular shields may also be mentioned. Bronze arrow-heads are rarely met with, and that stone was still used for these objects is proved by the frequent discovery of tanged and barbed flint arrow-heads in interments. Other stone implements of the Bronze Age include knives and daggers, axe-hammers and double axes with cylindrical perforations, and mace-heads.

In hafting bronze implements, the provision of a tang preceded the development of a socket, which occurs in some celts, daggers, spear-heads, hammers, sickles, etc. Amongst the personal ornaments are bronze pins, armlets, and torques. No metals other than copper, tin, lead, silver, and gold were known to the men of the Bronze Age. Gold was made into rings, armlets, necklets, earrings, and the crescentic plates called *lunulæ*, characteristic of Ireland. Lead and silver were little used.

That the bronze implements were many of them made by casting is proved by the discoveries of stone and metal moulds that were used for the purpose.

It is not necessary to enter upon a detailed description of the various types of bronze implements, since they are, in the main, of forms easily recognisable by comparison with later tools and weapons. A brief account may, however, be given of the forms of celt, in which interesting stages of development may be traced.

Early metal celts were thin and flat, the edge being hammered to increase its width and to harden the metal; such celts are often of copper, and they were probably hafted by being fixed in a slit passing through the terminal part of a wooden haft, or by attachment to a shouldered haft. Plain bronze celts are also found, but in many cases their shape was adapted to improved methods of hafting. In most forms two laterally placed flanges were raised on each face of the celt, which was fixed, no doubt with the aid of a lashing, in a cleft of the short arm of a shouldered haft; later a ridge ("stop-ridge") was provided across the middle of each face so as to stop the celt from being forced more deeply into the cleft in the haft. By further development of this form, the *palstave* was produced, which is characterised by the presence of a deep groove on each face of the butt-end, for the reception of the two prongs of the haft, each groove ending in a sharp rise, representing the stop-ridge. Later forms have a projecting loop, through which a cord was passed for attachment to the haft.

The evolution of the bronze *socketed celt* has been much discussed, but no general agreement has yet been reached. Probably the

view most commonly held is that which derives it from the winged celt, which has two deep flanges on each side of the butt, curved inwards so that a kind of double, but incomplete, socket is produced. By union of the flanges, and suppression of the partition, a single complete socket might have been evolved ; but it seems more probable that the socket had its origin, in part at least, in a simpler type of celt, or hoe-blade, having a single incomplete socket produced by the bending inwards of the two margins of a wide butt. After the discovery of the method of core-casting (see below), a complete socket could be produced, and by the introduction of the method into those parts of Europe where the winged celt was in use, the socketed celt took its place. On some socketed celts there are two pairs of curved ridges occupying the positions of the margins of the four wings of the winged celt, but these are in imitation of the appearance presented by the older type, and do not afford convincing evidence as to the mode of origin of the socketed celt.

The Museum collection of bronze implements is small, and can scarcely be called representative. There are, however, specimens from various parts of the British Isles and the Continent, including early flat celts from Ireland, tanged dagger-blades, knives, spear-heads, sickles, swords, etc., There are also series bearing upon the development of the palstave and the socketed celt.

The Casting of Copper and Bronze Implements.

Copper can only be satisfactorily cast in open moulds, and not until bronze was produced was it possible to make use of closed moulds such as are necessary for all but the simpler forms of implements. Flanged celts, palstaves, socketed celts, spear-heads, daggers, swords, etc., were cast in moulds that were in two closely-fitting halves. Moulds of stone, or half-moulds, have been found in some numbers, and others are of bronze, but no doubt many of them were of clay or compact sand, and have not survived.

For the producing of sockets such as those of spear-heads and socketed celts, it was necessary to fit into the mould a core which would restrict the metal to a layer forming the socket, and this process of *core-casting* was a late achievement of the Bronze Age.

Casting by the *cire perdue* process was also known in the Bronze Age ; in this method a model of the object was made in wax, and this was closely enveloped in coatings of clay. When the molten metal was poured into the mould, the wax melted and flowed away through holes left for the purpose, the metal taking its place and assuming its form ; or the wax might be melted and got rid of by a preliminary heating, which also hardened the clay mould.

The Decorative Art of the Neolithic and Bronze Ages.

The decorative art of the Neolithic and Bronze Ages was mainly of a geometrical character, and consisted of such elements of design as lines and dots, hatchings, zig-zags, herring-bone, chevrons, circles, and spirals. These may be impressed or incised on pottery, and (in the Bronze Age) cast or engraved on bronze implements and ornaments; designs are sometimes found cut on the stones of megaliths. The graphic representations of animals which formed such a conspicuous feature in the art of the later cave-men, played no part in that of their successors, though more or less conventionalised figures of men and animals occur on rocks and megaliths in some regions (Liguria and Scandinavia).

The Bronze Age in the early civilisations of the Eastern Mediterranean was a period in which decorative art (on pottery, metal, stone, etc.) reached a very high level, in realistic as well as conventional styles. The civilisation of Crete, which ran its full course between about 3000 and 1200 B.C., developed into an extraordinary efflorescence of Bronze Age culture, as is shown in the excavated buildings and palaces of the island. The most direct influence exercised by this culture was on the later civilisation of Greece, but even before this had taken effect the North and West of Europe, by sea-route and land-route, had been to some extent brought into contact with Minoan (Cretan) influences.

The Round Barrows of the Bronze Age.

The round barrows raised over their dead by Bronze Age man in Britain are far more numerous and more widely distributed than the Neolithic long barrows. They usually occur in groups, and may be 20 to 100 feet in diameter and 8 feet or more in height.

Sometimes they are surrounded by a ditch, or by a ring of standing stones, and they occur in several varieties (disc-barrows, bell-barrows, etc.).

The body was either cremated before burial, or buried without cremation, and in the former cases the ashes were often placed within or beneath a cinerary urn of earthenware. Both burnt and unburnt bodies might be placed in a hole in the ground, without any covering, but sometimes the grave was lined with stones, or the hollowed-out trunk of a tree was used as a coffin. Sometimes a tomb of large stones was built, over which the mound was erected, and the kist (see p. 69) was also one type of stone tomb or coffin. Some barrows were built up in several layers, each containing a burial. In some instances a number of bodies appear to have been disposed of at the same time, as in the Neolithic barrows.

Whereas the long barrows, as already noted, have provided relatively little evidence bearing upon the material culture of Neolithic man, the round barrows have been more generous to the archæologist.

Implements of stone and bronze, pottery, ornaments of gold, amber, and jet, and other objects, were sometimes buried with the body, though in the later part of the Bronze Age (when barrows were less generally raised over the dead) this was not usual. The later types of bronze implements, such as swords and socketed celts, are not found in barrows.

Bronze Age Pottery.

In Britain, the pottery was all made without the aid of the wheel and the method of coiling was in use. The chief forms were vessels to which the terms drinking-cups or beakers, food-vessels, incense-cups, and cinerary urns have been applied. Only in the case of the last-named does the evidence of purpose justify the name. The decoration of the pottery is entirely geometrical, and was mainly produced by making imprints in the clay, before baking, by means of various objects and materials. It is not improbable that decorated pots were used only for sepulchral purposes, and that the pottery made for domestic use was plain, but this cannot be regarded as proven. It is interesting to note, however, that the people of the Yang Shao, or Late-Neolithic, Period in Kansu (Western China) made painted pottery which is only found in graves, and a different class of painted ware for domestic purposes.

The Bronze Age pottery of the continent includes much finer wares than that of Britain.

There are, unfortunately, no examples of Bronze Age pottery in the Museum.

Case 37)

THE EARLY IRON AGE

With the Early Iron Age we enter on a period which in Europe is transitional from prehistoric to historic times. In the West, the conquering arms of the Romans brought the Early Iron Age to an abrupt conclusion, and imposed a uniform standard of civilisation on the barbarians of Gaul and a large part of Britain. To attempt to discuss the relationships between the peoples of the South-East and South, and those of the West and North-West of Europe, would be to go far beyond the scope of a handbook of this kind. A summary and partial treatment is not only necessary but perhaps excusable, inasmuch as the Museum possesses practically no specimens of the Early Iron Age.

The knowledge that metallic copper could be obtained from certain kinds of stone by the aid of great heat may have led to experiments with other stones, and it was perhaps in this way that iron ores were first discovered. Nothing definite is known on this question, however, and the discovery may have been made by accident. In Egypt, iron was known in its meteoric form centuries before it was obtained from its ores, and the same is probably true of Mesopotamia. The way was, therefore, paved for the recognition of terrestrial iron, and even perhaps for the quest of it.

There is evidence to suggest that iron was obtained in quantity from its ores in Asia Minor about 1500 B.C., in the region south of the eastern end of the Black Sea. Iron objects of earlier date than this are in some cases proved to have been made from meteoric iron, which may be identified by its content of nickel (usually from 5 to 10 per cent.). The period of the first beginning of the working of terrestrial iron is not finally determined, however, and it has been suggested that 2000 B.C. is not too early a date for Asia Minor, if certain Hittite documents are rightly interpreted. A still earlier date is based on fragments of an iron dagger-blade, not made of meteoric iron, found at Tell Asmar in Mesopotamia, and attributed to the 28th century B.C. If this identification is accurate in all particulars, it is strange that iron was a rarity in Mesopotamia until 1100 B.C. Whatever value may be attached to these early evidences of iron-working, there is no doubt that it was known at Gerar, in Palestine, in the 14th century B.C.

The chief advantages of iron and steel weapons over those of bronze are the result of the greater hardness and elasticity of the former, but perhaps especially of the abundance of its ores and the ease with which they are smelted. Iron was therefore cheaper than bronze. Tools and weapons of bronze were liable to lose their edge and become bent much more easily than those of iron, and more especially steel. It has been suggested that the greater cheapness and abundance of iron tools, especially the iron-bladed axe, were important factors in the spread of prehistoric peoples

into densely wooded regions, which could now be more easily cleared of trees, and so made available for villages and cultivated fields.

The change from bronze to iron was naturally a gradual one, and the period of transition lasted in the West from about 900 to 600 B.C., with later dates for Britain. Bronze was not entirely displaced, even in the later phases of the Iron Age, but continued in use more especially for personal ornaments and other decorative purposes. Weapons and appliances of every-day use were, however, eventually made of the new material. We may be said to be living in the Age of Iron, though the value of the metal has been immensely increased by modern methods of producing various kinds of Steel in large quantities. It should be especially noted that during the Early Iron Age, and for many centuries after, iron was wrought, and not cast; the changes in the methods of the metal-worker from cast bronze to wrought iron were conspicuous. It was not until the 14th century A.D., that cast-iron was produced in Europe. Steel, usually as a mere superficial layer, was sometimes arrived at in quite early times, as an accidental result of methods of treating iron objects.

The most valuable information concerning the early part of the European Iron Age is derived from discoveries made at Hallstatt, the site of an ancient burial place in the Tyrol, and at La Tène, in Switzerland, where the remains of a village on piles were found in the Lake of Neuchâtel. At Hallstatt were found numerous bronze and iron objects belonging to the period when iron was replacing bronze. The specimens from La Tène are of later date, and all the ordinary implements were of iron. The terms **Hallstatt Period** and **La Tène Period** are applied to the cultural phases represented by the remains from these two sites, and by corresponding finds in other parts of Europe. The Early Iron Age in Britain belongs in the main to the La Tène Period, but it is usually called the Late-Keltic Period. Remains of the later part of the Hallstatt Period have been found in this country, and the culture was introduced by early Keltic invaders from the region of the lower Rhine, in the 7th to 6th century B.C. They took possession of eastern and south-eastern Britain, afterwards extending westwards, and a great number of hill-forts are assigned to these people. All Cannings Cross (near Devizes) has provided important relics of this culture. About the 4th century B.C., a second Keltic invasion, largely of La Tène character and coming mainly from Brittany, affected in the first instance the south-west of England, later spreading to the east and north. These people also erected many hill-forts. A third invasion, or a series of invasions, began about 75 B.C., at first influencing the south-east of England. These last intruders were the Belgae (who gave their name to the modern Belgium),

and they brought over a late La Tène culture, which is represented especially in the Aylesford cemetery (see below).

In Late-Keltic Britain there was a great indigenous development of La Tène art and industries, which continued after the greater part of Western Europe came under Roman rule. Even after the Romans had established themselves in Britain, Late-Keltic art continued its evolution in Scotland and Ireland for some centuries.

Whilst the burials at Aylesford have yielded objects that were placed with the dead, the relics from the Lake Village of Glastonbury, in Somerset, afford glimpses of the surroundings of the living ; and whereas Aylesford represents the latest of the invading and conquering people—the Belgic warriors who overran Kent and neighbouring regions before Cæsar came—the lake settlement was in the occupation of villagers belonging to the earlier La Tène immigration.

The Glastonbury Lake Village was of the *crannog* type, being built in the lake on a supporting foundation of peat, brushwood, logs, stones, etc., kept together by vertical piles and horizontal beams. The foundations of numerous huts have been traced, most of them being circular. They had a thatched roof, supported by a vertical centre-pole, and the walls were of wattle-and-daub. The relics found within the limits of the settlement (now dry land), and near the pallisade that surrounded it, indicate a peaceful folk possessed of few weapons, but pursuing many village arts and crafts. The domesticated animals were the ox, sheep, goat, pig, horse, dog, and fowl, and their bones are much more abundant than are those of wild animals.

Wheat, barley, and beans were cultivated and used for food. In this connection it is important to note that numerous examples of the rotary handmill, or quern, have been found, as well as of the older saddle-quern. The rotary form was no doubt introduced into this country in the Early Iron Age, and it has continued in use down to recent times in remote parts of our islands. Reaping-hooks of iron were found. The few weapons included iron swords, daggers, and spear-heads, and sling-pellets of clay.

The occurrence of iron " currency bars," similar to those found in other parts of South Britain, is probably evidence of a condition with regard to barter and exchange which is closely paralleled in parts of Africa to-day.

Spindle-whorls (of stone, bone, etc.) and loom-weights and other parts of looms, indicate a knowledge of spinning and weaving.

Most of the pottery was hand-made, by the method of coiling, but the potter's wheel was also in use ; decoration is often present as incised designs, which are sometimes of a Bronze Age character (chevrons, lozenges, etc.), though many are Late-Keltic, showing festoons, semi-circles, and scrolls.

Of wood were made such utensils and appliances as tubs, ladles, mallets, tool-handles, ladders, wheels, and dug-out canoes, whilst antler had many uses. Amongst the iron, or iron-bladed, tools, were axes, adzes, chisels, knives, bill-hooks, nails, saws, and files. Needles and pins were of bone or bronze, and beads were made of glass, amber, and jet. Mirrors and brooches were of bronze. Evidence of the working of metal in the village was found in the form of earthenware crucibles, and fragments of bronze, iron, lead, and tin.

In the "urnfield" at Aylesford (Kent), the remains of the cremated bodies were placed in urns, and buried in shallow pits, no mound being raised. The pottery is of a much finer character, both in material and form, than that of any earlier period, and it was made on the potter's wheel; some specimens are decorated with graceful cordons or ribs, and with incised linear designs. It is important to note that the potter's wheel, like the rotary quern and the chariot wheel, was first used in Britain in the Early Iron Age, though it was in use in the Bronze Age in some parts of Europe.

One of the most interesting objects in the Aylesford find was a pail made of wooden staves bound with bronze bands. The upper of these bands is decorated with a scroll design, and representations of animals in *repoussé* work. This pail, and other objects found at Aylesford, give proof of the spread of classical influences, and even objects, as far west as Britain.

Case 37) THE ART OF THE EARLY IRON AGE.

The style of art developed in various parts of Europe, and especially in Britain, during the Early Iron Age, is of such interest that a brief reference to it must be made. Its origin may be traced, to a large extent, to the influence of designs which developed in association with the civilisation of the ancient Greek peoples, and some of the designs suggest relationship with the even earlier Mycenæan (Minoan) culture. The term Late-Keltic is usually applied to the ancient British art of the La Tène period, and its local continuations, and it is especially characterised by graceful flowing curves, rounded surfaces, and by designs which are derivatives of the palmette of the Greeks. Figures of animals, usually of fanciful shapes, and masks of human faces were often represented. Many of the designs are executed in bronze in *repoussé* work, but the art of enamelling was well developed in England and in France. Works of art in wrought-iron have been found, and bronze was cast as well as wrought into ornamental designs, often further beautified by chasing, engraving, and enamelling.

As an exceptionally fine example of the art of the period may be mentioned the enamelled bronze shield found in the

Thames at Battersea, and now in the British Museum. Although this shield shows the influence of Greek art, it was made with an artistic skill which is characteristic of the best phase of the Late-Keltic Period in Britain.

The bronze *fibulæ*, or brooches of the safety-pin type, are noteworthy for the elaboration of their shapes and ornamentation. The fibulæ found on the Continent have been classified in chronological order, and are used in the sequence-dating of finds of other objects.

NEOLITHIC AND LATER TYPES OF MAN IN EUROPE.

It is usual to regard the population of Europe as consisting of a mixture of three main ethnic types. None of these types is now found in a state of racial purity, and intermixture had produced conspicuous effects even in prehistoric times. Each type had, however, a region of distribution in which it was predominant, and even to-day this predominance persists to a varied extent, though no nation in Europe has any claim to purity of blood. Individuals, and even communities, may be recorded as representing the nearest possible approach to one of the three main ethnic types, but the racial purity of a nation is a political myth.

With these warnings, the chief characters of the types may be summarised as follows :—

The **Mediterranean type**, with narrow-head, long face, rather broad nose, dark complexion, low stature, slender build.

The **Northern or Nordic type**, often called also Teutonic or Germanic, is characterised by a narrow head, long face, narrow aquiline nose, light complexion, and tall stature.

The **Central or Alpine type**, with broad head and face, large nose, sallow complexion, medium stature, and broad, thick-set build.

The three types appear to have been in Europe at the beginning of the Neolithic Age, and their relationships to their Palæolithic forerunners are not known. The Mediterraneans appear to have been the first on the ground, and it may be that the Nordics were an offshoot of this type. The Alpines apparently came originally from Asia, which is especially characterised by the frequency of broad-headedness amongst its peoples. In later times, well into the historical period, intrusions of other broad-headed Mongoloids from Asia affected the peoples of Europe, especially in its eastern areas.

Some observers have identified types which are believed to indicate the survival of characters of Late Palæolithic man.

The sub-division of European peoples into only three main types, intermixed with and diluted by intrusions from Asia and

Africa, is a simplification which omits a great deal that is important, but for classifications that enter more fully into local and regional types, the reader is referred to special treatises. Since, however, the term Aryan has recently achieved a revived notoriety, it should be mentioned that to speak of an Aryan race, or an Aryan nation, is again a politician's fantasy. Aryan is a term that can only be applied to the forms of speech that can be classified as Aryan languages. There are no identified Aryan races, or peoples, or nations, but practically all the languages of Europe are Aryan languages, and they are spoken by Mediterraneans, Alpines, and Nordics, by Gentiles and by Jews, by Mongoloids and Negroes.

The population of the British Isles is mainly a Mediterranean-Nordic mixture, with some Alpine infusion. The Mediterraneans were here in Neolithic times, and, as we have noted, the Bronze Age was inaugurated by the arrival of the Nordic-Alpine Beaker-folk. In the Early Iron Age other waves of immigration added similar elements to the population. The Keltic peoples who brought iron to the British Isles included the Goidels or Q-Kelts, and the Brythons, or P-Kelts, and there are many unsettled problems relating to the languages and the archæology of these peoples. Of later invaders, the Romans probably had little effect on the physical characters of the inhabitants of Britain, but the Saxons, the Danes, and the Normans, all of whom had strong Nordic affinities, left lasting marks on the population. In the more remote or inaccessible parts of England, Scotland, and Wales, the Nordic physique has never been so conspicuous as it is along the easterly areas of England and Scotland, and it is in the remoter regions that the Keltic language has survived. The population of Ireland is essentially similar to that of Great Britain, and here again there has been a survival of Keltic speech.

STONE AND THE METALS OUTSIDE EUROPE

FROM STONE TO IRON IN EGYPT.

Cases 38—42)

The stone implements found in Egypt indicate that stages of stone-age culture were passed through that were comparable with those of Europe. Both Palæolithic and Neolithic forms occur in great numbers, and many of the former have been found in gravels and other deposits of Pleistocene age, whilst others occur on the surface of the desert plateau.

Both the tongue-shaped and the ovate river-drift types are well represented (pl. 1, Figs. 2 and 6), and there are forms which agree in general character with those of later phases in Europe.

In Kharga Oasis there have been found, under conditions which permit of relative dating, implements of the following periods; Acheulian, Levalloisian, Pre-Sebilian (not represented in Europe), Aterian (related to European Mousterian), Capsian (related to European Mesolithic), Capso-Tardenoisian, and Neolithic (without polished celts). Neolithic chert arrow-heads and polished celts of about 5000 B.C. or earlier have been found at Badari and in the Fayum, together with serrated flints that had been parts of sickles. There is other evidence that proves the association of Neolithic types of implements with the growing of grain, and also with the making of pottery; in addition to numerous implements from the Fayum, there are shown in the case samples of grains of wheat and barley, and sickle-flints.

The manufacture and use of stone implements by no means came to an end with the termination of the Neolithic Age. Implements of advanced type were made during the succeeding predynastic period, which ended not long after 3500 B.C., and continued to be made for domestic and ceremonial purposes until much later times. The flaking of many of the earlier implements, especially those made just before the end of the predynastic period, indicates a degree of skill never equalled elsewhere. Amongst the forms found are axe-heads, usually unground, scrapers, borers, knives, arrowheads, etc. The bracelets or bangles of flint, chipped from a disc having a central hole (representing the apex of a cone of percussion), and afterwards ground and polished, are remarkable examples of flint-working. The flint knife exhibited shows parallel flaking executed with extraordinary precision and control of the material, and also a very fine serration of the edge. Such knives were first ground on both faces, the flakes afterwards being removed by pressure.

The first metal employed for implements in Egypt was copper, which was in use, together with stone, early in the predynastic period, whilst copper beads from Badari date back to Neolithic

times. The copper tools and weapons were at first shaped by cold hammering, but the art of casting was known before the end of the predynastic period, as was also the smelting of copper ore.

Bronze was coming into general use in Egypt between 1600 and 1300 B.C., though it was in use earlier (2000 B.C.) for small objects. It is improbable that Egypt had any share in the discovery of the alloy.

Meteoric iron was known in Egypt as a rare metal, long before it was extracted from terrestrial ores. The predynastic iron beads that have been discovered were no doubt made from meteoric iron. The use of iron made slow progress in Egypt after its ores were first smelted, and the metal forged into tools and weapons, in Asia (14th century B.C., or earlier). In this case again the art of iron-working was an introduction into Egypt, and the metal was only coming into common use about the 9th century B.C., or later, though iron implements began to make a rare appearance some centuries earlier.

THE STONE AGE IN AFRICA.

Cases 43—45)

(Excluding Egypt.)

The greater part of Africa appears to have passed directly from the use of stone to that of iron, no traces having been found of an age of copper or bronze. We do not know when stone was replaced by iron, which was already in use when Africa began to be explored in the 15th century. Only the Hottentots and Bushmen in the south used stone implements up to the time of coming of the white man. In South Africa, Kenya, Somaliland, and elsewhere, implements have been found which are identical in form with Palæolithic implements of Europe, and in most cases the workmanship is of Palæolithic style. (Plate I, Figs. 3, 7.) Both river-drift and cave types are represented, and so also are Neolithic forms. Flint was rarely available, but in East Africa obsidian was an excellent substitute. Quartzite was also much used in some areas. Ground and polished stone axe-heads have been found on the Gold Coast, in the Congo, and elsewhere ; in some instances there is evidence of the overlapping of the Stone Age with the African Iron Age.

The Stone Age in North Africa has relationships on the one hand with that of Egypt, and on the other with that of Europe.

In recent years, detailed investigations in South Africa, Rhodesia, and Kenya have revealed a close, though by no means an absolute, correspondence with the phases of the European stone age. The following comparable cultures have been established : Chellian, Acheulian, Levalloisian, Mousterian, Still Bay, Aurignacian, Wilton, Smithfield. The Still Bay culture appears to be a derivative of the Mousterian (or the

Levalloisian), the typical implement being a point or blade worked on both faces, resembling the Solutrian blades of Europe, but probably of independent origin ; Bambata Cave and other sites in Rhodesia have provided evidence of this evolution. There is evidence that in some areas (e.g. Rhodesia and Kenya) Aurignacian and Mousterian man may have been contemporaries. The Wilton culture has a Tardenoisian aspect, whilst the Smithfield makes an approach to Neolithic. The cultures just enumerated are most fully represented in East Africa, and it would appear that migration and diffusion were, as would be expected, from north to south. The exhibited specimens from South and East Africa are not very representative.

In addition to the cultures named above, there have been found in East Africa (Kenya or Uganda, or both) what are believed to be "eolithic" industries comparable in age and in implement-types with those of the East Anglian Sub-Crag. The Kafuan of Uganda is characterised by quartz pebbles chipped to the forms of cutting and chopping tools, and it has been compared with the Darmsdenian of the Sub-Crag. The Oldowan is also characterised by cutting or chopping tools, formed from a pebble or lump of rock trimmed roughly to a cutting edge along one side. The Uganda Cromerian is described as an industry of large flake-implements, sometimes with a little secondary trimming at the edges.

Mention may also be made of the puzzling Tumbian culture, which has long been known from the Belgian Congo, and has now been identified in Uganda, where it appears to be associated with the Upper Acheulian. The typical implements of the Tumbian are leaf-shaped blades and points worked on both faces, and whilst some forms approach the late types of Acheulian hand-axe, others are Neolithic in suggestion. Relationship with Still Bay types must also be considered. Specimens from near Stanley Falls, Belgian Congo, are exhibited.

The Magosian culture of Uganda is regarded as Mesolithic.

There are still many difficult problems as to the relationships between the European and African phases of the Stone Age, and the correlations cannot be regarded as settled.

Cases 46—47) THE STONE AGE IN ASIA.

Stone implements are widely distributed over Asia, examples having been discovered in Palestine, India, China, Siberia, Indonesia, Japan, and other parts. A detailed study of these implements is beyond the scope of this handbook, but those from Palestine, India and Japan, of which there are specimens in the Museum, may be briefly considered.

Palestine.

Palestine has contributed more to our knowledge of Palæolithic man than has any other part of Asia, even though scientific investigations only began in quite recent years. In caves on Mount Carmel, a succession of cultural stages has been established, and important remains of Palæolithic man himself have been unearthed. The oldest culture so far identified at this site is a flake-industry allied to the European Clactonian, and it has been called Tayacian, owing to its close resemblance to the industry of that name in France. This is followed by the Acheulian, after which comes an "Acheulio-Mousterian" layer. Succeeding deposits contain flake-industries, partly Levalloisian, and partly Mousterian, not easy to distinguish from each other. Specimens illustrating most of these phases are exhibited.

The Upper Palæolithic is represented only by the Aurignacian, and is succeeded by a Late Mesolithic culture to which the name of Natufian has been given ; it is characterised by notched arrow-heads, sickle-flints set in bone, mortars and pestles of limestone and basalt, whilst implements of bone include pins, harpoon-heads, and fish-hooks. The sickles suggest that the cultivation of grain had begun, but this cannot be regarded as certain. No pottery has been found, but it seems clear that Neolithic influence had been at work.

The skeletal remains include those of a type allied to Neandertal man, but associated with Levalloisian types of implements, and also of Natufians belonging to the modern type.

The Neolithic Age in Palestine is represented in the case by scrapers, knives, sickle-flints, and unground celts, all from Beth Pelet. Asia Minor is represented by polished celts.

India.

Many implements from India are of Palæolithic types, and some have been found in deposits of great antiquity, though rarely in association with the bones of extinct animals. The rude quartzite implements from the laterite (a red clay) beds of Madras closely resemble River-drift types, tongue-shaped and ovate implements both occurring (Plate I, Figs. 4, 8). Pygmy implements and some which are of European cave types are recorded, but further investigation is needed.

Implements of Neolithic type, such as polished axe-heads, are also found in India, as well as in the adjacent countries, including Burma, Cambodia, the Malay Peninsula, Java, and Borneo, some of them being of very specialised forms.

India became acquainted with the metals at a remote period, copper being apparently the first to be employed. Iron appears to have been known as early as the 12th century B.C.

Japan.

The stone implements of Japan are mainly of Neolithic type, and were apparently made by the ancestors of the modern Ainu, who formerly occupied the islands. These people are now found chiefly in Yezo and Saghalien, and they are only just emerging from their age of stone. The most primitive implements are found in shell-heaps comparable with the Mesolithic shell-mounds of Denmark, and many of them probably date from several centuries B.C.

Stone axe-heads, knives, arrow-heads, and borers are found, many of the smaller implements being made of obsidian.

The Japanese were already in possession of bronze when they first invaded the land, which they did from the south, driving the Ainu northwards.

China.

Within recent years important discoveries have been made in China which indicate relationships with stages of European prehistory. The *Sinanthropus* discoveries (see p. 53) stand alone, but in the Ordos Desert (and a few other sites) stone implements have been found which are assigned to the Palæolithic Age (Middle and Late). In Kansu and Honan have been discovered village sites and burial grounds of a Late Neolithic people, and to this phase the name Yang Shao has been given; in addition to the usual, and some unusual, Neolithic features, it is characterised by a profusion of painted pottery, comparable with that of Anau (in Russian Turkestan) and of the Tripolji culture of South Russia. Both Anau and Tripolji represent a stone-copper (Chalcolithic) phase, and the Yang Shao probably dates from a corresponding period, even though copper has not been found on the sites explored. Its date may be about 2500 to 2000 B.C. The Bronze Age is represented by discoveries of bronze implements and products that are Chinese in type, some of which perhaps date from as early as 1700 B.C.

Cases 48—53) THE STONE AGE IN AMERICA.

North and South America, and the adjacent islands, were for the most part in their age of stone at the time of their discovery and exploration in the 15th century and later. Copper and bronze were known, however, in Mexico and Peru, and as already mentioned, many tribes of North American Indians made implements from native copper by the simple process of hammering and grinding the metal, sometimes after softening it by heat. The question as to whether the discovery of the metals in America, and of the processes of smelting and casting, was independent of Old World influences cannot be regarded as finally settled. Meteoric iron was occasionally treated in the same way as copper, and the

use of hæmatite for ornaments and implements was frequent in some areas.

There is no satisfactory evidence that America ever passed through a period in which the implements were of Palæolithic type, and we must provisionally conclude that it was first colonised by men who had already reached a stage of culture which, as regards stone-working, and some other arts and crafts, was comparable with that of Neolithic man in Europe. Human remains and implements have been found, however, that are claimed as Pleistocene by some investigators. Considerable stress has recently been laid on a type of implement to which the name "Folsom point" has been given. These are, however, often of fine workmanship, by no means suggestive of a Pleistocene date; even their discovery in deposits underlying bones of extinct animals does not bring conviction that man was in North America as early as the closing phases of the Glacial Period of the Old World. On the basis of this and other evidence, however, it has been suggested that the first discovery and colonisation of America (from north-east Asia) may have been as long as 10,000 years ago.

Stone implements were in use for many years after the white man began to overrun the country, and we have therefore more accurate knowledge of the uses and methods of manufacture of the implements than is the case in most other regions. Many of the implements are preserved in the state in which they were used; in remote parts they are still in use, but over the greater part of the double continent the introduction of iron and steel by civilised man rapidly led to the complete displacement of stone. The bow and stone-headed arrow, and the stone-bladed tomahawk were, for example, soon discarded for the gun and the iron-bladed axe.

The stone implements in North America especially, were made in great variety of forms, and include many types not represented in Neolithic Europe. The uses of some of these are not known, and they are included under such terms as "ceremonial objects," "bird-shaped objects," etc. Others resemble the European specimens, though in many cases they were made in forms characteristic of the region. The provision of a groove round the stone heads of axes, hammers, and clubs is very characteristic of North America. Flint was used comparatively rarely, especially for the larger implements, which were made from softer varieties of stone. Many of the flaked points and blades show very fine workmanship, in flint, quartz, agate, jasper, chalcedony, obsidian, etc.

The stone implements from the West Indies are often remarkable for their size and the peculiarity of their forms, as will be seen from the specimens exhibited.

Since the South American Indians long remained, in some areas, outside the influence of the white man, stone implements have not yet gone entirely out of use, though this is only true of remote and inaccessible regions. Stone celts, arrow-heads, etc. are exhibited, and also a few implements of copper and bronze from Ancient Peru.

The Eskimo of North America (and also Greenland and the extreme North-East of Asia), are a stone-age people, but they make use of bone and ivory to an extent unknown elsewhere. The ivory is usually obtained from walrus tusks, though sometimes fossil mammoth-ivory is employed. The white man's iron has largely displaced stone, but the Eskimo had themselves advanced as far as the hammering out of implements from native copper and meteoric iron, though only on a small scale and in particular districts. (For examples of the bone and ivory carvings of these people see the section of Decorative Art in the West Hall.)

Cases 54—57) THE STONE AGE IN OCEANIA.

The Stone Age has not yet come to an end in parts of Australia and New Guinea, whilst in other parts, and in most of the islands of the Pacific, the iron of the civilised trader has brought it to an abrupt conclusion. The stone implements are mainly such as might have been made by Neolithic man in Europe, the most characteristic being the ground and polished stone blade for axe, or adze, which was used in Australia, New Guinea, Fiji, Solomon Islands, New Zealand, Hervey Islands, Hawaii, and elsewhere. These are made in shapes which are often characteristic of particular islands or groups of islands, and there is a general distinction between those of the Melanesians and the Polynesians respectively; Polynesian celts usually have squared sides, and sometimes the butt is narrowed to form a tang. There is sometimes a strong suggestion that the form of the celt is derived from that of a metal original of advanced type. Melanesian celts rarely have squared sides, these being usually either rounded or linear.

It is interesting to note that flint *tranchets*, identical in form and technique with those of Mesolithic Europe, were formerly used as adze-heads in the Solomon Islands.

Arrow-heads of stone are practically unknown in Oceania, and stone spear-heads only occur in Australia and the Admiralty Islands. The usual absence of flint, and the presence of easily obtained shells, no doubt affected the development of the use of stone for small tools, such as scrapers, borers, and knives, whilst the use of bone and suitable kinds of hard wood did away with the necessity for spear-heads and arrow-heads of stone. Knives, also, were made by splitting pieces of bamboo stem, whilst knives, and even swords and spears, were made of wood edged with

sharks' teeth. Axe-heads and adze-heads of shell were made where suitable stone was not obtainable, as in the Carolines and other coral islands.

The most primitive stone implements of Oceania are those of the recently-extinct Tasmanians, which are flakes of stone, often dressed at the edges. They were never attached to hafts, and in form and technique they may be paralleled by European implements of the Mousterian and Aurignacian cultures.

In some parts of Australia the aborigines still make and use stone implements, and it is characteristic of these people that their implements range from the crudest types to ground and polished axe-heads and finely chipped spear-heads. The fragments of stone that are attached, by means of gum which hardens on exposure, to wooden knife-stems or spears, forming saw-like cutting edges, have no standard form.

The methods of attachment of some of the stone implements to their hafts may be seen from the specimens exhibited under Oceania, and other examples will be found amongst the tools, the weapons, and in the series illustrating Methods of Hafting (see also p. 19). The shouldered haft was in general use in the Islands, but not in Australia, where the axe was formed by bending a flexible wooden haft round the stone blade ; the adze proper, which was the predominant wood-working tool in the Islands, was wanting in Australia, its place being filled (as far as was necessary) by a simple type of chisel.

The use of shell, teeth, bone, and wood in this part of the world may be studied in other sections. It is interesting to compare the implements of the peoples of Oceania with those of the Eskimo. In both cases stone occupies a subsidiary position, but whereas in Oceania, wood and shell and vegetable fibres are abundantly and freely used, amongst the Eskimo, bone, ivory, and the sinews of animals play the most important part, wood being difficult to obtain and therefore used sparingly.

THE ADOPTION OF IRON, GLASS, ETC., BY PRIMITIVE RACES.

Case 58)

The spread of civilisation over the earth has been the means of abruptly terminating the Stone Age in most of the regions where it persisted until modern times. The American Indians, the Eskimo, the aborigines of Australia, and other peoples, have learnt the advantages possessed by iron over the materials they formerly used, and we find that this metal has more or less completely displaced stone and bone. Trade axe-heads, knives, pieces of hoop-iron, etc., are eagerly sought after by stone age peoples. Glass bottles, and even telegraph insulators, have been utilised as materials for spear-heads in Australia, and arrow-heads of glass are made in Tierra del Fuego ; sometimes,

however, specimens of this kind are made for sale to the white man, and not for use.

In many regions the natives have learnt the use of the later inventions of civilised man, such as firearms, though their resources are not equal to the task of manufacturing these weapons.

MISCELLANEOUS

THE MODERN MANUFACTURE OF GUN-FLINTS, ETC.

(Cases 59—60)

The working of flint is still carried on at a few places in this country and on the Continent, though for the purpose of producing objects different from those which were made in ancient times. Brandon, in Suffolk, is perhaps the best known of these localities, and here there are manufactured gun-flints for export to countries where the flint-lock gun is still in use, though the industry has greatly declined during the present century. The flint is extracted from mines sunk in the chalk, and in some cases the implements used are, or were until recently, of shapes suggesting those of Neolithic man. This is especially the case with the miner's pick, which has only one point, like the stag-antler pick of Neolithic times. Until recently, also, a round-headed hammer was used, suggesting the rounded hammer-stone of the earlier workers.

In the process of manufacture of gun-flints, a block of flint is first broken by means of a "quartering" hammer, in such a way as to detach masses with surface as plane and even as possible. One of these masses is then shaped by means of a "flaking" hammer, so that subsequent blows with the same tool will remove long flakes with one plane surface, the other bearing two ridges. These flakes are then cut to the size of the gun-flints required, by means of an upright fixed chisel and a "knapping" hammer, and the gun-flints are finished by chipping the edges.

The specimens exhibited include flint-miners' and flint-knappers' tools, and examples of various forms of gun-flints. There are also gun-flints, etc., made in France and Albania, as well as specimens illustrating modern flint-working in Central Africa. Tinder-box flints and blocks for facing the walls of buildings are the principal other products of the modern flint industry.

COUNTERFEITS AND FORGERIES OF STONE IMPLEMENTS.

(Cases 61—62)

Many imitations of stone implements have been made since their interest and importance first began to be realised. In some cases successful attempts have been made to reproduce the implements of Stone Age man, with a view to ascertaining his method of working.

Imitations of both Palæolithic and Neolithic implements have also been extensively made for purposes of fraud. These forgeries are not restricted to copies of genuine implements, but are sometimes of forms unknown amongst the latter. Various

devices have been adopted for giving an appearance of antiquity to these modern productions, but as a rule the fraud is easily detected.

Edward Simpson, usually known as "Flint Jack," earned a wide notoriety in England between 1840 and 1860 as a forger of stone implements, though most of his productions were coarse and obviously modern, as may be seen from the specimens exhibited. In more recent years many forgeries of flint implements were made by an expert workman in or near London. He had acquired considerable skill in the flaking of flint, but his ignorance misled him, and his productions usually have features which arouse suspicion. The forms are in most cases slightly —often considerably—outside the range of genuine types, and in one case at least (as is shown in the case) the same "patina" and the same sand were applied to a mixed lot of his "Palæolithic" and "Neolithic" types.

STONE IMPLEMENTS AND SUPERSTITION.

Although there is no special Museum series dealing with the subject, brief reference must be made to some modern applications of ancient stone implements to purposes that did not enter the minds of those who made them. In many parts of the world stone implements are found by metal-using "savages," or by the uneducated in civilised countries, and are regarded as objects of mysterious origin. They are therefore believed to possess magical properties, and are carried or worn or used as amulets and talismans ("charms"). Stone celts, in particular, are looked upon in many parts of the world as "thunderbolts," which protect the owner or his property from lightning-strokes. Flint arrow-heads have been regarded (in Ireland, for example), as fairy-arrows ("elf-darts"), and cattle were believed to fall sick through being shot by malicious fairies. By boiling one or more arrow-heads in water, and administering this to the cattle, the illness might be cured. In parts of West Africa scrapings from celts (regarded as thunderbolts) are used medicinally in a similar way for human subjects.

Examples of stone implements illustrating these superstitious uses will be found amongst the Amulets and Talismans in the Magic and Religion section in the Emslie Horniman Hall.

Even among the educated in Europe, it was not until the early part of the eighteenth century that prehistoric stone implements began to be recognised for what they are, and it was not until about the middle of the following century that progress began to be made in unearthing and interpreting the evidence that has been outlined and discussed in this Handbook.

A LIST OF SELECTED BOOKS IN THE LIBRARY OF THE MUSEUM.

With few exceptions only books published in or after 1900 have been included here, but the library also contains works by the older authorities (Avebury, Beddoe, Boyd-Dawkins, Evans, Lartet and Christy, Greenwell and Rolleston, Montelius, Pitt-Rivers, and others).

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